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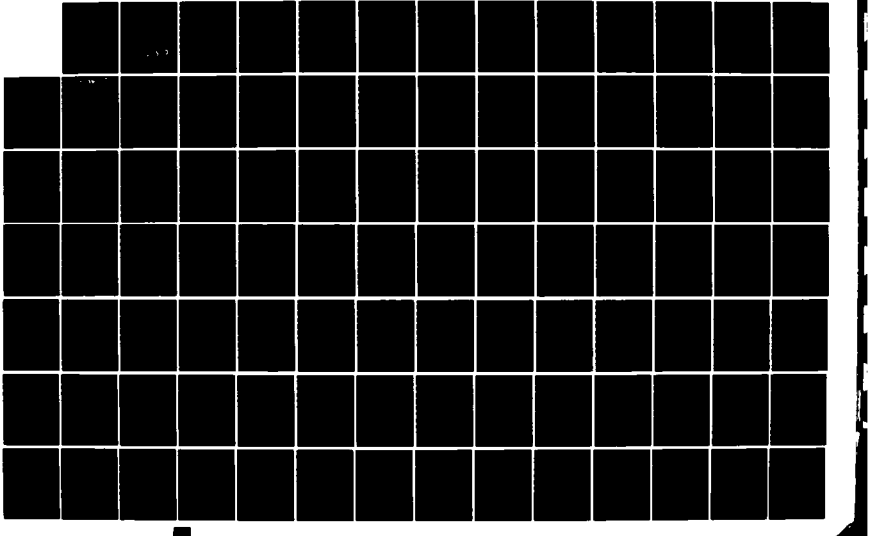
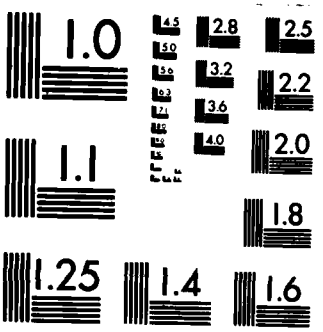




MERRIMACK RIVER BASIN

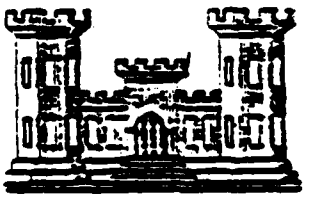
FITCHBURG, MASSACHUSETTS

OVERLOOK RESERVOIR DAM AND DIKE

DAM ——— MA 00876

DIKE ——— MA 01335

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

AUGUST 1980

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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Fitchburg Massachusetts
Tributary-North Nashua River

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The dam is a 370± ft. long, 47± ft. high, earth embankment structure with a masonry core wall and a stone masonry gatehouse. The dam and dike are generally in fair condition. It is small in size with a high hazard potential. The reservoir receives inflow from a drainage area of 40 acres.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
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Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the Overlook Reservoir Dam & Dike Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, City of Fitchburg Water Dept., Fitchburg, Mass.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA 00876 (Dam), MA 01335 (Dike)

Name of Dam: Overlook Reservoir Dam and Dike

City: Fitchburg

County and State: Worcester County, Massachusetts

Stream: Tributary-North Nashua River

Date of Inspection: April 11, 1979 (Dam), June 17, 1980 (Dike)

Overlook Reservoir Dam is a 370± foot long, 47± foot high, earth embankment structure with a masonry core wall and a stone masonry gatehouse. There is a separate 900± foot long, 25 foot high dike with an 10 foot long concrete channel spillway, located along the northern part of the reservoir. Construction of the project was completed in 1872. The dam and dike have always been owned and operated by the City of Fitchburg for the purpose of water supply.

The visual inspection indicated the dam and dike to be in generally fair condition. Heavy vegetation, animal burrows, surficial sloughing and erosion were observed on the side slopes of the dam. Excessive tree growth and seepage was observed at the dike. Leakage into the valve chamber located upstream of the chlorination building was observed and the functionability of the control valves at the facility are questionable.

The project has a size classification of small and a hazard classification of high. Based on Corps Guidelines, the test flood has a range between a 1/2 and full probable maximum flood (PMF). The test flood used was the 1/2 PMF.

The reservoir receives inflow from a drainage area of 40 acres. Additional inflow is received from the 24 inch diameter Shattuck Brook and Scott Reservoir conduit to maintain an adequate water level.

The assumed test flood produced a calculated inflow of 94 cfs. The resulting outflow is 70 cfs which will surcharge the spillway by 0.65 feet (elevation 835.65+). The spillway has a capacity of 1447 cfs with the water level at the top of dike (elevation 840.2). The top of dam is at elevation 841.5+. The test flood outflow requires only 5 percent of the spillways capacity. Therefore, neither the dam or dike would be overtopped by the test flood. There are no records of the dam or dike being overtopped.

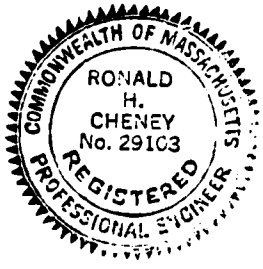
There were no indepth engineering data available and therefore, the condition of the project was evaluated based primarily on the visual inspection, past performance history and sound engineering judgement.

It is recommended that the owner engage a qualified registered professional engineer to investigate the soft, wet areas on the downstream slope of the dike; design a means to correct the erosion of the downstream slope of the dike; specify procedures for removal of trees, existing stumps and their tree root systems from the dam and dike; quantitatively monitor the flow of water through the discharge pipes and at the spring downstream of the dam embankment relative to reservoir level and design an upstream control to regulate inflow into

the intake structure or outflow through the two water supply lines. The owner should also determine and correct the cause of leakage into the valve chamber located upstream of the chlorination building. Remedial measures regarding operating and maintenance procedures should include the following:

1. Removal of brush and briars on the slopes of the dam and dike.
2. Refill stump holes and animal burrows in the downstream slope of the dam.
3. Repair erosion and surficial sloughing damage on the downstream slope of the dam with compacted fill.
4. Repair spalled concrete on spillway walls.
5. Repair the approach channel riprap at the spillway inlet.
6. Place additional riprap around the spillway outlet.
7. Test and repair (as required) all valves on a regular basis.
8. Repair and maintain the outlet channel at the 12 inch outlet drain.
9. Install a floor deck for the service bridge.
10. Develope a formal downstream warning system.
11. Institute a program of annual technical inspection.

The above recommendations and remedial measures should be implemented by the owner within 1 year after receipt of this Phase I inspection report.



Ronald H. Cheney, P.E.
Vice President
Ronald H Cheney
Hayden, Harding & Buchanan, Inc.
Boston, Massachusetts

This Phase I Inspection Report on Overlook Reservoir Dam and Dike has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to

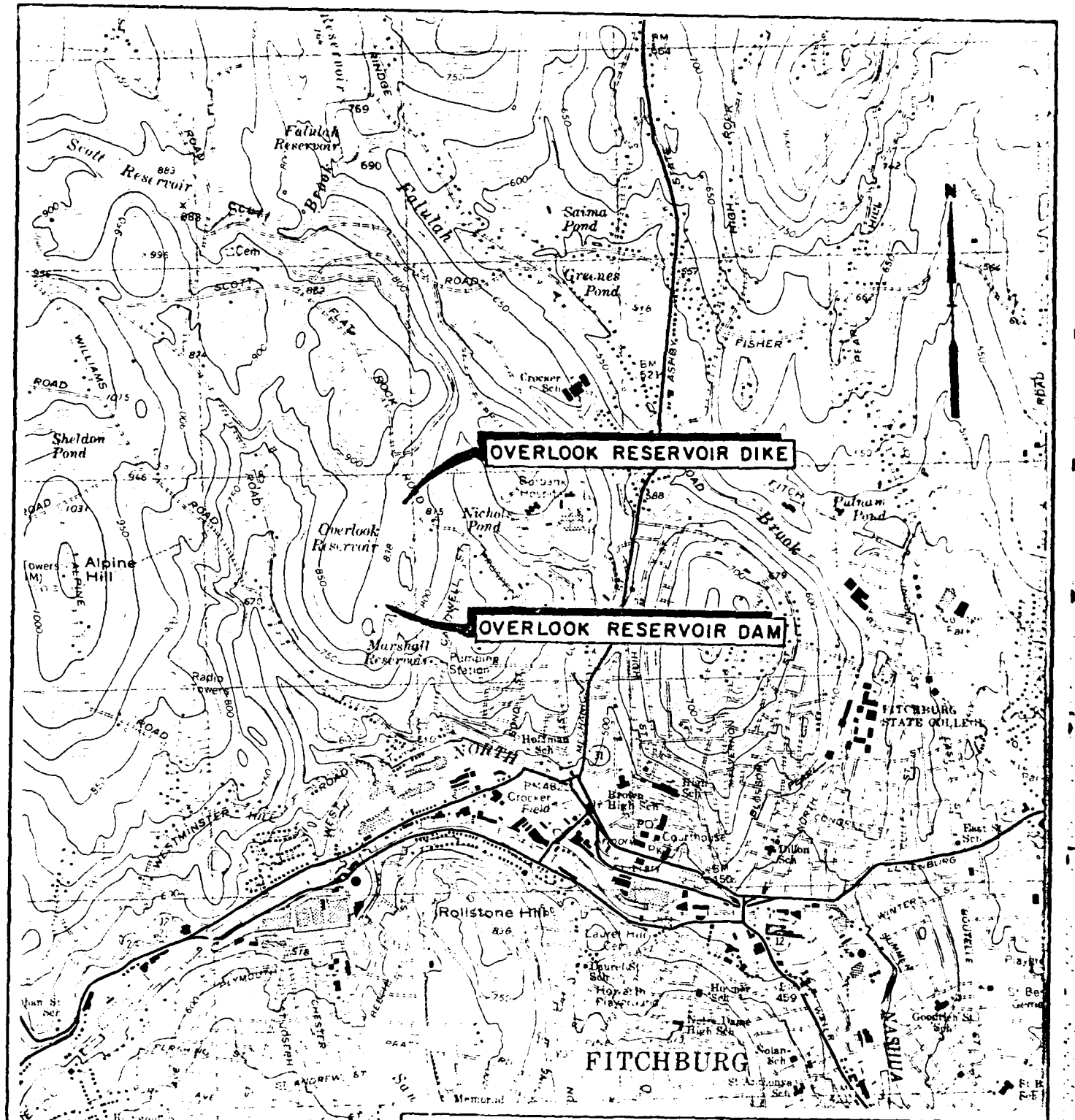
assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

CONTENTS


OVERLOOK RESERVOIR DIKE
OVERLOOK RESERVOIR DAM



HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OVERLOOK RESERVOIR DAM & DIKE

FITCHBURG MASSACHUSETTS

			SCALE 1" = 2000'
			DATE JULY, 1980

PHASE I

NATIONAL DAM INSPECTION PROGRAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Hayden, Harding & Buchanan, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued Hayden, Harding & Buchanan, Inc. under a letter of 28 November 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-79-C-0012 has been assigned by the Corps Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Overlook Reservoir is located in the City of Fitchburg, Worcester County, Massachusetts. The dam is located along the southern shore of the reservoir. The dike is located along the northern shore. The dam is shown on the Fitchburg Massachusetts Quadrangle with coordinates approximately at North 42°35'38", West 71°49'10", The dike has the approximate coordinates of North 42°35'54", West 71°49'02".

b. Description of Dam and Appurtenances

The dam is a 47± foot high, 370± foot long, earth embankment with a masonry core wall and a stone masonry gatehouse. This gatehouse also serves as the intake structure. The dam, an earth embankment, has a maximum fill height of 40± feet and a crest width of approximately 20 feet. The riprapped upstream side slope is inclined at 2H:1V and the highly vegetated downstream side slope is inclined at 1.5H:1V (see Photographs 4 and 6).

The 45± foot high masonry core wall is located approximately at the longitudinal center line of the dam crest. It varies in thickness from about 1 foot at the top to 21" at the base and extends vertically to within about 1.5 feet of the top of crest (see plan, elevation and cross sectional sketches in Appendix B).

The granite masonry gatehouse is located approximately 40 feet upstream of the crest (Photographs 5 and 6). A steel service bridge provides access to the gatehouse. The access bridge is new, and the floor had not been put in place at the time of the dam inspection.

A 12 inch drain line is located at the upstream toe of the embankment (elevation 797.5±), approximately 25 feet upstream of the intake structure. Water drawn through this line would pass through the base of the gatehouse, beneath the dam embankment and outlet into a small stream 60 feet west of a chlorination building located beyond the downstream toe (Photograph 2). A gate valve is located at the base of the gatehouse for control of this drain line. Two additional lines, a 12 inch and a 16 inch, exit from the gatehouse running beneath the dam, into the chlorination building and eventually into the City water system. There is a slotted screen opening located on the upstream side of the intake structure. Water inlets through this screen opening into the intake structure and outlets into the 2 water supply pipes. There are no known outlet controls for the water supply pipes located within the intake structure. There are two below grade valve chambers which are located on the upper and lower sides of the chlorination building. Manual valve controls located within these chambers regulate flow through the chlorination building. There is a valve located within the upper valve chamber which can control flow through the drain line. These chambers are further described in Section 3.1.c.

There is a separate 900± foot long 25 foot high earthen dike located along the northern shore of the reservoir. The upstream side slope of the dike is inclined at about a 2.5H:1V

slope and is riprapped to within about 4 vertical feet of the crest (Photograph 11). The upper portion is highly vegetated. The crest of the dike is at elevation 840.2± and is about 20 feet wide. The downstream side slopes are thickly vegetated and inclined at about 1.5 to 1.75 horizontal to 1 vertical. A 6.2 foot deep by 10 foot long concrete emergency spillway is located at the left side of the dike (photo 9). This spillway discharges into a 24 inch CIP waste pipe (photo 10) which outlets approximately 350 feet downstream of the spillway (photo 14). There is a 24 inch inlet pipe located approximately 60 feet left of the spillway (photo 13). This pipe provides inflow to Overlook Reservoir from Shattuck Brook and Scott Reservoir (see section 1.3.a for a further discussion of this inlet pipe).

c. Size Classification

The project (Dam and Dike) has a size classification of small, based on the storage capacity of 254 acre-feet and the hydraulic heights of 40 and 25 feet, respectively.

d. Hazard Potential

This project has a hazard potential classification of high. The dam and dike have separate failure impact areas. Based on Corps Guidelines, the assumed dam and dike failure outflows are 45,900 cfs and 20,500 cfs, respectively.

Dam failure flood stage will vary from eight to eighteen feet deep in the 3000 foot long impact area. Ten homes, three mill buildings, a church, a playground, two water department buildings and a small water supply reservior will be damaged by failure flooding. There is a potential for the loss of many lives due to an assumed dam failure.

Dike failure flood stage will vary from three to sixteen feet deep. The impact area is almost two miles long and extends into the heavily developed areas of Fitchburg. At least two hundred buildings (residential and commercial) will be damaged by failure flooding. There is a potential for the loss of a significant number of lives due to an assumed dike failure.

e. Ownership

The project has been owned by the City of Fitchburg Water Department since it was completed in 1872.

f. Operator

The project is maintained and operated by the City of Fitchburg Water Department. Mr. J. Andre Provencial is the Water Superintendent. The Water Department address is City Hall, 718 Main Street, Fitchburg, Massachusetts 01420. Telephone (617) 342-5722.

g. Purpose of Dam

The purpose of the project has always been water supply.

h. Design and Construction History

The project was designed by Phineas Ball of Worcester, Massachusetts in 1871. Construction began in 1871 and was completed in 1872. The emergency spillway was added to the project in about 1960. No other records indicating modifications to the original structure were located.

i. Normal Operating Procedures

There are no formal operational procedures for the project. Normally the downstream water supply gates are left open, the waste gate is closed, and the quantity of water entering the Fitchburg water system is controlled by a downstream regulating station.

1.3 Pertinent Data

a. Drainage Area

The drainage area, 40 acres (0.06 s.m.), is comprised of wooded, undeveloped land. Two undeveloped roads cross the drainage area. Flat Rock Road, to the north, borders the spillway and dike. The second road, to the east, is an access road used to reach the reservoir area. This road also runs along the top of the main dam to give access to a Girl Scout Camp adjacent to the southwest side of the dam.

The reservoir is located in an upland area, thus it has a very small runoff area. It was originally intended to be supplied with additional water from a 14,000 foot long, 24 inch diameter pipe line which begins above Lovell Reservoir, to the north. This pipe line was to be supplied with water from a dam proposed for that location. However, this dam was never constructed. The 24 inch pipe line presently receives some inflow from the Shattuck Brook intake (a small ungated diversion structure with inflow limited by pipe size). Water can also be added from Scott Reservoir by gravity flow (which is also connected to the 24 inch pipe) as required to maintain the water level in Overlook Reservoir.

b. Discharge at Damsite

The outlet works consist of one 16 inch and two 12 inch diameter pipes. The invert elevation at the intake structure is about 797.5±. The 16 inch pipe and one of the 12 inch pipes are used for water supply. Their discharge capacity is controlled by water demand within the supply system. Their maximum capacities would be about 40 and 20 cfs, respectively.

They extend to Marshall Reservoir and along Caldwell Street towards West Street. The third pipe is a 12 inch main drain. It discharges to the west of the chlorination building into a small outlet brook. Its outlet invert is about elevation 796±. Its maximum capacity would be about 20 cfs.

c. Elevation (ft. above NGVD)

(1) Streambed at centerline of dam ---------- 801±

(2) Maximum tailwater ---- none from spillway discharge

(3) Upstream portal invert diversion tunnel ------ none

(4) Recreation pool ---------- N/A

(5) Full flood control pool ---------- N/A

(6) Spillway crest ---------- (ungated) 835.0±

(7) Design surcharge (Original Design) -------- unknown

(8) Top Dam ---------- 841.5 (Top of dike 840.2±)

(9) Test flood design surcharge ---------- 835.65

(10) Water Supply ---------- varies-maximum of 835±

d. Reservoir

(1) Length of maximum pool ---------- 1600'

(2) Length of water supply pool ---------- 1600'

(3) Length of recreation pool ---------- N/A

(4) Length of flood control pool ---------- N/A

e. Storage (acre-feet)

(1) Spillway crest pool ---------- 187

(2) Water supply pool ---------- varies-maximum of 187

(3) Test flood pool ---------- 196

(4) Top of dike ---------- 254

(5) Recreation pool ---------- N/A

(6) Flood Control pool ---------- N/A

f. Reservoir surface (acres)

(1) Spillway crest ---------- 11.2

(2) Water supply ---------- maximum 11.2

(3) Test flood pool ---------- 12.0

(4) Top dike ---------- 15.6

(5) Flood-control pool ---------- N/A

(6) Recreation pool ---------- N/A

g. Dam and Dike

(1) Type ---------- gravity, earth fill

(2) Length ---------- 370'± main dam; 900± dike

(3) Height ---------- 47'± main dam; 25'± dike

(4) Top Width---------- 20.0'±

(5) Side Slopes ---------- Dam-U.S.2H:1V, D.S. 1.5H:1V;
Dike U.S. 2.5H:1V D.S. 1.5 to 1.75H:1V

(6) Zoning ------- indications on D.S. side of dam only

(7) Impervious Core ---------- unknown

(8) Cutoff ------- Stone masonry wall-dam; unknown-dike

(9) Grout curtain ---------- none

(10) Other -------- Riprap on U.S. slope of dam and dike

h. Diversion and Regulating Tunnel ---------- none

i. Spillway

(1) Type ----- see photo 9, 10' long x 6.2' high x 80' wide concrete channel

(2) Length of weir ---------- 10' (bottom of channel)

(3) Crest elevation ---------- 835.0±

(4) Gates ---------- none

(5) U/S Channel ---------- none

(6) D/S Channel ------drop-off to 24" CIP, see photo 10

(7) General ---------- added to dike about 1960±

j. Regulating Outlets

Regulating outlets have been discussed in detail in Section 1.3.b. Briefly, they consist of a 16 and 12 inch water supply pipe and the 12 inch main drain. The three outlet pipes can be controlled by manual gate valves located in buried chambers at the downstream toe near the chlorination building. The main drain also has a manual valve inside the intake building. According to water department personnel this valve is normally kept open. The condition of the valve is unknown. There is no known outlet control for the water supply pipes located within the intake structure.

The 12 inch gate valve on the main drain in the valve chamber is reported to be broken and kept permenantly closed. The other downstream gate valves are reportedly operable but they are not normally operated and are kept open at all times.

Outflow is regulated downstream at the Marshall Reservoir regulating station. Overlook Reservoir is brought into use during periods of high water demand.

SECTION 2

ENGINEERING DATA

2.1 Design

According to a 1933 County Inspection Report, Phineas Ball of Worcester, Massachusetts was the design engineer for this project. An unsigned plan dated 1871, showing a cross sectional view of the embankment and gatehouse was located at the Fitchburg Engineering Office. No design calculations for the dam or dike were located.

2.2 Construction

No construction data was discovered for this dam or dike.

2.3 Operation

No written operational manual was discovered for this project.

2.4 Evaluation

a. Availability

A design plan dated 1871 and a piping detail showing the location of outlet facilities were made available at the Fitchburg Engineering Department. County Inspection Reports for the years 1924 through 1964 were made available at the Worcester County Engineering Department. State Inspection Reports for the years 1975 and 1976 were made available at the Department of Environmental Quality Engineering, Division of Waterways, Boston Office.

b. Adequacy

The lack of indepth engineering design data does not allow for a definitive review. Therefore, the condition of

this dam, structurally and hydraulically, can not be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound engineering judgement.

c. Validity

The field investigation indicated that the external features substantially agree with the supplied information.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

The Phase I Inspection of the dam was performed on April 11, 1979. At that time, the water level was 11.3 feet below the top of dam, and about 4.8 feet below the spillway crest. During the June 17, 1980 inspection of the dike the water level was approximately 8 feet below the top of the dike.

b. Dam and Dike

The dam consists of a main embankment section at the south end of the reservoir about 370 feet long with a maximum hydraulic height of 40 feet. An embankment dike with a maximum height of about 25 feet encloses the reservoir at the north end. A concrete emergency spillway also passes through the dike at the north end of the reservoir. Photograph 4 shows the downstream face and the crest of the main dam viewed from the left abutment.

1. Dam

Upstream Slope

The upstream face of the main dam is on a slope of 2H:1V. Riprap of two types extends from the water level to about 3 feet of the dam crest. The upper riprap consists of large blocks of granite, which appear to have been hand placed, and the lower riprap consists of smaller dumped rockfill. The water level at the time of the April 1979 inspection was approximately 8 feet below the top of the riprap. Photograph 6 shows the two levels

of riprap and the grass covered upstream face above the riprap. There were no visual indications of slumping or sliding, and the riprap appeared to be in good condition.

Crest

The crest of the dam is approximately 20 feet wide. As shown in photograph 5, a sand and gravel roadway crosses the crest of the dam. No cracking or misalignment is evident.

Downstream Slope

The downstream face is on a slope of 1.5H:1V. Although trees and heavy brush have been removed, remaining brush and briars make close inspection of the downstream face difficult. Several large stumps have been removed leaving large holes in the slope up to 2 feet deep - some within 10 feet of the crest. Many smaller stumps have not been removed. Several animal burrows with 8 to 10 inch diameters and depths greater than 2 feet were observed on the face within 20 feet of the crest. An eroded footpath extends from the toe to the crest on the downstream face across from the gatehouse at approximately Station 1+70 (see plan view in Appendix B).

The downstream face of the dam is generally undulatory. A bowl-shaped, shallow depression was observed in the downstream face between Station 2+40 and 2+70, with the center of the depression located approximately 15 feet below the crest. This depression may be an old slide or slough area. Several large trees were observed at the lower portion of the downstream face and at the toe area, as shown by photo 7.

A chlorination building is located approximately 80 feet downstream from the toe of the dam. A sand and gravel roadway passes between the chlorination building and the toe of the dam and extends around to the right side of the building. Approximately 100 feet downstream of the toe and approximately 60 feet to the right of the chlorination building, a 12 inch diameter iron pipe emerges from beneath the roadway embankment. At the time of the inspection, the end of this pipe was half filled with sand and gravel, and clear water, approximately 4 inches deep over the sand and gravel, was existing from the pipe into a stream, as shown in photograph 1. The source of this is not known.

The head of the stream is located at the base of the roadway embankment upstream from the 12 inch diameter pipe, as shown in photograph 2. Water observed to be seeping from the base of the roadway embankment was clear, however some silt deposits were observed in the head of the stream.

Downstream from the 12 inch diameter pipe, clear water was observed to exist under pressure from two 1 inch to 2 inch diameter plastic tubes (photograph 3), which appeared to be waste lines from the chlorination plant.

2. Dike

The dike consists of an earth embankment approximately 900 feet long with a maximum height of about 25 ft. The axis of the dike has an approximately 90^{o} bend at about it's midpoint.

There is a concrete spillway structure between the dike and the left abutment. The spillway structure is shown in Photo 9.

Upstream Slope

Photo 20 shows the upstream slope from the right abutment to the point of dike curvature and Photo 17 shows the slope from the spillway to the point of curvature. The upstream slope is inclined at 2.5H:1V. The riprap on the slope is in good condition. There is no riprap on the upper 4 feet (measured vertically) of the slope.

The unprotected portion of the slope above the riprap is overgrown with dense brush and small trees. This growth may be seen in Photos 17 and 20.

No slumping or slides were noticed on the upstream slope.

Crest

The crest of the dike is 20± feet wide and is unpaved. Vehicles may drive along the entire crest gaining access from the right abutment. Vehicular traffic has caused minor erosion of the crest as shown in Photo 15. The dense growth along the upstream and downstream slopes is visible in Photo 15.

No misalignment or unusual settlement of the crest was observed.

Downstream Slope

The downstream slope is inclined at about 1.5 to 1.75H:1V. The slope is covered with dense growth including many small trees with occasional larger trees. One tree, a few feet below the downstream toe has a trunk diameter of about 20 inches. Dead trees with trunk diameters greater than 12 inches were observed on the slope.

Photo 18 shows the downstream slope at midheight viewed from the point of dike curvature toward the right abutment. Photo 16 shows a deep erosion path that has been worn on the downstream

slope at the point of dike curvature. The path leads from the dike crest to the roadway at the toe of the dike.

Photo 19 shows a wet area located at the downstream toe at the point of curvature of the dike. The area was swampy and soft with free water standing at some locations. At the time of the inspection, it was judged that this wet area was probably a result of seepage through or beneath the dike.

A second wet area was located at the toe of the dike about 250 feet from the right abutment. This area, which is beneath a row of large pine trees, was soft but had no standing water.

c. Appurtenant Structures

The spillway is a 10 foot long by 6.2 foot deep concrete channel. It is located adjacent to the left abutment of the dike, at the north end of the reservoir. Photographs 4, 6, 9 and 11 show the spillway, dike and dam area. The overall condition of the spillway and outlet channels are generally good. Some concrete on the northwest spillway wall is spalling as shown by photograph 9. The spillway discharges towards an undeveloped wooded area. A 24 inch pipe (Photograph 10) will carry some of the outflow into the wooded area. The remainder will flow overland.

The intake building, located at the main dam, contains a 12 inch gated reservoir drain line and two water supply pipes. Water inlets into the intake structure through a screened opening and outlets into the two water supply pipes. There is no known control for the water supply pipes located within the intake structure. The condition of the drain line valve is unknown. The drain and two water supply pipes pass under the main dam, to a valve chamber. The access bridge to the intake structure was being replaced. The deck had not been installed at the time of inspection.

Downstream of the main dam (photograph 7) is a chlorination building. The two (12 and 16 inch) water supply lines pass through this facility. On either side of the building there is a valve chamber. The three outlet pipes, enter the upstream valve chamber where each pipe is gated. One 12 inch line is the main drain. After exiting the upstream valve chamber, this pipe extends to an outlet brook about 60 feet from the chlorination building (see plan view in appendix B). Its valve, inside the chamber is reportedly inoperable and left in a closed position. Some leakage is evident as shown by Photo 1.

There is also a smaller, 6 inch, pipe entering this valve chamber from the direction of the access road. This pipe is ungated and there was a small amount of inflow visible. This pipe appears to be a "drain" for the downstream area. No record of its existence or purpose was found. The two remaining water supply pipes pass through the chlorination building and then into the other valve chamber.

At this chamber, each pipe has a check and a manual gate valve. The 16 inch line has a 12 inch manually gated by-pass around the valve chamber. It appears that the Water Department has small sampling lines and additional chlorination capabilities inside the chamber. There is also a 1 inch water supply pipe extending from the 12 inch water main to a Girl Scout summer camp located on the hillside adjacent to the dam.

All gate valves (except for the drain line) are reportedly operable. Flow from the dam is controlled downstream by a regulating station, as water demand requires.

Manhole covers were removed from atop both of the valve chambers for observation. The water level in both chambers was found to be approximately 7 feet below the surface. These chamber's manhole covers are normal 6 inches below grade, to prevent vandalism.

d. Reservoir Area

The reservoir area is comprised of wooded undeveloped land as shown by photograph 4. The visual inspection showed the overall reservoir area to be in general agreement with the U.S.G.S. map. A description of the drainage area is given in Section 1.3.a of this report. The amount of siltation in the reservoir is not known.

e. Downstream Channel

The downstream channel is a small unnamed brook beginning at the roadway embankment upstream from the 12 inch diameter drain pipe (photo 2). The brook is feed by the waters seeping from the base of the roadway embankment, discharge from the 12 inch drain line (photo 1) and the 1 to 2 inch diameter pipes (photo 3). The channel was observed to be free and clear. The channel eventually flows to the North Nashua River.

3.2 Evaluation

Visual inspection indicates that the main dam is in fair condition with respect to the geotechnical aspects. Disturbance of the downstream slope by removal of vegetation and animal trespassing was observed. Some local sloughing also may have occured.

Considerable quantities of water were observed discharging downstream from the dam in the forms of (1) seepage from a spring and (2) discharge from a 12 inch diameter iron pipe. Representative of the Fitchburg Water Department stated that the water discharging

from the 12 inch diameter pipe originates in the upper buried gate vault near the toe of the dam; however, they did not know if the water flowing into the gate vault was caused by seepage through the embankment or by faulty valves in the outlet pipes. Since there is no upstream control of inflow into the intake structure or outflow through the two water supply pipes, these pipes are always under pressure. Leakage of these pipes could cause an embankment failure. Upstream controlls should be provided.

At the time of the April 1979 inspection, the downstream discharge appeared to be flowing in a controlled manner and no surface seeps or springs were observed on the dam embankment or within 50 feet downstream of the toe of the embankment.

Visual inspection indicates that the dike is in fair condition.

The presence of dense growth of bushes and trees on the downstream slope and at the toe of the dike make it impossible to inspect these areas adequately, although several problems are observable as described below.

The numerous trees, some of them quite large and dying or dead, could cause shortened seepage paths through the embankment leading to internal erosion.

The presence of soft wet ground and standing water at the downstream toe of the dike may be the result of seepage conditions which, if not controlled, could lead to failure of the dike.

Active erosion of an area on the downstream face at the point of curvature render this area less resistant to runoff from rainfall or due to overtopping if it should occur. Such erosion, if left unrepaired, could cause failure of the dike.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure

The purpose of the dam is water supply. Normally the 2 water supply outlet pipes remain open, the 12 inch drain gate is closed and the outflow from the chlorination building into the City water system is controlled by a downstream regulating station.

4.2 Maintenance of Dam

The general maintenance of the dam is performed by the Fitchburg Water Department. Recent maintenance consisted of the cutting and clearing of overgrown brush on the upstream and downstream embankment faces.

4.3 Maintenance of Operating Facilities

There is no formal operational procedure for this facility. The dam is used for water supply on a regular basis. Deficiencies in operational facilities should be detected during normal operating procedure.

4.4 Description of Warning System

There are no warning systems at this facility.

4.5 Evaluation

There is no formal maintenance procedure for this dam. Cutting vegetation on the upstream and downstream faces should be performed on a regular basis. The outlet valves should be periodically operated to evaluate their condition. The dam should be inspected annually by qualified personnel who can identify conditions of concern which if left unchecked could jeopardize the safety of the dam.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The project was designed and is used as a water supply facility. It is comprised of an earth fill dam with a hydraulic height of 40 feet and a separate 25 foot high (hydraulic height) 900± foot long dike. The useable storage capacity is 254 acre-feet. The spillway is located at the northerly end of the dike. Photographs 4,5,6,11 and 12 show views of the dam and dike.

b. Design Data

The project was completed in 1872. Design calculations were not located. Some record drawings were found. The dam was designed and has always been used for water supply. It was designed to be connected, by a 14,000 foot long 24 inch pipe line, to a proposed dam at Shattuck Brook, which was never constructed. This dam was to be located 5,000 feet north of the existing Lovell Reservoir. The 24 inch pipe receives some flow from an intake structure on Shattuck Brook and from a 20 inch pipe connected to Scott Reservoir.

c. Experience Data

Overtopping of this dam (top elevation 841.5) or the dike (top elevation 840.2) has never been reported. During the August 17 to 20, 1955 flood period, about 4 inches of rainfall occurred in the Fitchburg area. Gage station 1-0945 is maintained by the U.S.G.S. on the North Nashua River near Leominster. It recorded a maximum discharge of 16,300 cfs (152.34 cfs/s.m.) for a 107 s.m. drainage area on March 18, 1936.

The level of the reservoir varies, but is usually below the spillway level of elevation 835. The small drainage area (40 acres) and limited additional inflow from other sources coupled with a high water demand could substantially lower the reservoir level. Thus, it is used only to provide an additional supply of water during periods of high water demand. Water can be drawn from Scott Reservoir to keep the water level from dropping too low.

d. Visual Observations

The main dam and dike, show no indications of having been overtopped. The spillway crest is about 5 feet below the top of the dike and shows no indications of outflow having occurred recently. The water level was several feet below the spillway elevation of 835 when inspected. Observations of the drainage area and general vicinity show them to be generally as indicated on the U.S.G.S. map and as described in Section 1.3 of this report.

e. Test Flood Analysis

Due to the projects small size and high hazard potential classification, the Corps guidelines indicate the test flood to be within the range of the 1/2 PMF to full PMF. The 1/2 PMF was chosen for this project. The 1/2 PMF inflow for this drainage area of 40 acres would be 94 cfs. With the water level at least one foot below the spillway elevation of 835, the storage capacity is large enough to retain test flood runoff without the water level reaching elevation 835. With the water level assumed at the spillway crest, the test flood would surcharge the reservoir to elevation 835.65. The test flood outflow would be about

70 cfs. The dam and dike would not be overtopped. The spillway has a capacity of 1447 cfs with the water level at the top of dike, elevation 840.2. The 24 inch outlet pipe just beyond the spillway (photograph 10) could carry about 25± cfs of the test flood outflow. The remaining 45 cfs, would flow across Flat Rock Road into the adjacent woods. The outflow would eventually flow to Nichols Pond, about 2000 feet downstream.

f. Failure Analysis - Dam and Dike

Dam

The dam was assumed to have failed with the water level at the top of dam, elevation 841.5. Forty percent of a 270 foot long section (taken at midheight) of the forty foot high dam was assumed to have failed. The resulting outflow would be 45,900 cfs. The failure impact area is confined to a "narrow" outlet channel which extends about 3000 feet to West Street and the North Nashua River. Most development occurs near West Street. The first structure to be flooded is the chlorination building, near the toe of dam. The chlorination building would be flooded by at least 15 feet. No other developments occur until Marshall Reservoir about 1000 feet downstream. There, the reservoir, and the pump and chlorination buildings would be flooded. Flood stage would reach 12 feet. For the next 1000 feet, Caldwell Street parallels the outlet brook. Here, flood stages would reach 12 to 16 feet.

Between Arlington Street and West Street, flood stages would reach 8 to 12 feet. About 10 homes, a church, a playground, several mill buildings and roads would be flooded.

Additional damage could occur along West Street as floodwaters flow over the street. Beyond West Street and the mill buildings, the ground level drops towards the North Nashua River.

Since there is no spillway discharge to cause flooding in this outlet channel, all damage will be due to dam failure. Many of the structures located along this outlet channel will be destroyed. There is a high potential for the loss of many lives due to dam failure, particularly at the developed areas of Arlington and West Streets.

Dike

The dike was assumed to have failed with the water level at elevation 835.5 (test flood elevation; approximately 5' below top of dike). Forty percent of a 340 foot long section of the 900 foot long and 25 foot high dike was assumed to have failed. Water depth at failure was assumed to be 20 feet. The resulting outflow is 20,500 cfs.

The failure impact area extends about two miles, from the dike into the downtown Fitchburg area. Little development occurs within the impact area (several roads and five houses) until 4700 feet downstream of the dike, at Mechanic Street, where numerous structures were built in the "narrow" outlet channel. Flood stages between the dike and Mechanic Street will vary from 4 to 16 feet deep. Five houses could receive about two feet of flooding damage. Roads are flooded to deeper depths, up to 15 feet deep, due to their locations near brook crossings.

Beyond Mechanic Street, towards downtown Fitchburg, numerous development (residential and commercial structures) are located within the impact area. The flood stage will be at least three feet deep through this area and numerous structures (at least 200) will be flooded. There is a high potential for the loss of a significant number of lives due to dike failure flooding.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Visual inspection did not disclose any immediate structural problems at the main dam; however, the downstream slope was observed to be very undulatory, and a 30 foot wide shallow depression was observed approximately 15 feet below the dam crest which may be indicative of past problems with erosion and surficial sloughing. The cause of the water flowing into the gate vault should be determined to learn if it is the result of seepage through the dam.

The roots of large pine trees at the toe of the main dam opposite the chlorination building could shorten seepage paths if a tree blows over.

The visual examination revealed the following potential structural problems at the dike:

(1) The presence of soft, wet ground and standing water at the downstream toe may be the result of seepage conditions which, if not controlled, could lead to the failure of the dike.

(2) Active erosion on the downstream slope increases the possibility of erosion failure due to heavy and prolonged rains or due to overtopping should it ever occur.

(3) Large dead trees on the downstream slope could shorten seepage paths that could lead to internal erosion of the dike.

A dense cover of vegetation on the downstream slope makes it impossible to inspect the dike and downstream toe area adequately.

b. Design and Construction Data

According to drawings dated 1871, and inspection reports dated 1924, Overlook Reservoir Dam has a masonry core wall founded in "rocky soil", and the embankment consists of earth and rockfill with a zone of "selected material" placed on the downstream side of the masonry core wall. Details on the embankment construction are not available.

One 16 and one 12 inch water supply pipe, and the 12 inch waste pipe pass through the main dam at its base. A 12 inch waste pipe is shown to exit from the downstream gate vault in the general direction of the 12 inch diameter iron pipe shown in photograph 1.

No information concerning the construction of the dike was available.

c. Operating Records

Inspections conducted by the Commonwealth of Massachusetts Department of Environmental Quality Engineering in 1975 and 1976 concluded with the recommendation that a consultant inspection be conducted due to the seepage noted. Letters from the D.E.Q.E. to the City dated February 24 and December 21, 1977 list this dam with others in the City of Fitchburg as unsafe, again urging the City to retain the services of a registered professional engineer.

d. Post-Construction Changes

According to records from the Commonwealth of Massachusetts inspections, sometime prior to 1975 seepage had produced a large wet area downstream of the toe of the main embankment, and a gravel pad was placed over the toe area to improve the access to the chlorination building. Records of the 1975 inspection indicate that two 8 inch pipes exit from this gravel pad. These two pipes were not observed during the inspection reported herein.

e. Seismic Stability

The dam is located in Seismic Zone 2, and in accordance with the recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The visual inspection indicates that the main dam and dike are in fair condition.

The presence of soft, wet ground and standing water at the downstream toe of the dike may be the result of seepage which, if not controlled, could lead to internal erosion and failure of the dike.

The presence of trees, some of which are dead, on the downstream slope of the dike could cause shortened seepage paths that could lead to internal erosion of the dike.

Active erosion on the downstream face of the dike increases the possibility of erosion failure due to rain or overtopping should it occur.

Since there is no upstream control of inflow into the intake structure or outflow into the two water supply pipes, these pipes are always under pressure. Leakage from these pipes could cause undermining of the embankment and possible embankment failure.

b. Adequacy of Information

The information made available, along with the visual inspection, are adequate for a Phase I investigation.

c. Urgency

The recommendations made in Section 7.2 and the remedial measures suggested in Section 7.3 should be implemented within one year after receipt of this report by the owner.

d. Need for Additional Investigation

No additional investigations are needed to complete the Phase I inspection.

7.2 Recommendations

The owner should retain a registered professional engineer to:

(1) Investigate the soft, wet areas on the downstream slope of the dike.

(2) Design a means to correct the erosion of the downstream slope of the dike.

(3) Specify procedures for removal of trees and their root systems from the downstream slope of the dike and from the downstream area of the main dam directly opposite the chlorination building. Specify procedures for removing remaining stumps and their root systems from the slopes of the dam. Assist in the selection of suitable fill materials for backfilling the voids left in the embankment after removal of tree root systems.

(4) Quanitatively monitor the flow of water through the discharge pipes and at the spring downstream from the main embankment as a function of reservoir level.

(5) Design an upstream means to control inflow into the intake structure or outflow into the two water supply pipes.

The owner should also determine whether the leakage of water into the valve chamber upstream of the chlorination building is caused by faulty valves and, if so, the valves should be repaired.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

The owner should implement the following:

(1) Remove the brush and briers from the downstream slope of the dam and dike.

(2) Existing stump holes caused by previous removal of trees and animal burrows on the downstream slope of dam should be backfilled with compacted fill.

(3) Repair erosion and surficial sloughing damage on the downstream slope of the dam to produce a uniform downstream slope.

(4) Spalled concrete on spillway walls should be repaired.

(5) The approach channel riprap at the spillway inlet should be relaid in mortar to prevent undermining of the spillway.

(6) Additional riprap should be placed around the spillway outlet to prevent soil erosion in the drainage path, along the toe of dike.

(7) All valves for outlet pipes should be tested on a regular basis to insure they are operable. Inoperable valves should be repaired.

(8) The outlet channel for the 12" drain should be cleared (near pipe outlet) and riprap placed for erosion control. The outlet pipe should be flushed clean.

(9) A floor deck should be installed on the service bridge.

(10) The owner should develop a formal warning system to notify downstream areas in the event of an emergency. Around the clock monitoring of the facility should be provided during periods of heavy precipitation.

(11) Institute a program of annual technical inspection.

7.4 Alternatives

There are no practical alternatives for this project.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Overlook Reservoir

DATE April 11, 1979

TIME 10:00 AM

WEATHER 50° F clear

W.S. ELEV. 830.2± U.S. _____ DN.S.

PARTY:

1. Ron Cheney HHB
2. Dave Vine HHB
3. Mike Angieri HHB
4. Dan LaGatta GEI
5. John France GEI
6. Bob Stetkar GEI
7. Maurice Caron-Fitchburg Water Dept.
8. _____
9. _____
10. _____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Spillway	Ron Cheney, Dave Vine, Mike Angieri	
2.	Service Bridge to Intake Building	Ron Cheney	
3.	Dam Embankment	Dan LaGatta, John France, Bob Stetkar	
4.	Hydraulic/Hydrologic	Mike Angieri	
5.	Dike*	Dan LaGatta, Ron Cheney, Dave Vine	
6.			
7.			
8.			
9.			
10.			

* Dike inspection on June 17, 1980

PROJECT OVERLOOK RESERVOIR DAM — DATE April 11, 1979

PROJECT FEATURE Embankment Dam — NAME D. LaGatta, J. France

DISCIPLINE Geotechnical Engineer — NAME R. Stetkar

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	841.5
Current Pool Elevation	830.2±
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	None. Sand and gravel road on crest
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No misalignment observed
Horizontal Alignment	No misalignment observed
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	No structural items on slopes
Trespassing on Slopes	Several animal holes and one footpath toe to crest at Sta 2+00
Sloughing or Erosion of Slopes or Abutments	Possible sloughing of downstream slope between Sta 2+40 and 2+66. Some erosion of downstream slope-very rough undulatory surface
Rock Slope Protection - Riprap Failures	Upstream riprap in good condition. No riprap on downstream slope
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	Water seeping into stream approx. 100 ft downstream of dam-source unknown
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None
Vegetation	Some depressions in downstream slope from rotted tree stumps. Downstream slope and top of upstream slope are grass covered and have stumps of recently cut brush

PERIODIC INSPECTION CHECK LIST

PROJECT OVERLOOK RESERVOIR DIKE DATE June 17, 1980

PROJECT FEATURE Embankment Dike NAME D.P. LaGatta

DISCIPLINE Geotechnical Engineer NAME R.H. Cheney

Structural Engineer

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	840.2
Current Pool Elevation	832.2±
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed.
Pavement Condition	No pavement on dike.
Movement or Settlement of Crest	None observed.
Lateral Movement	No misalignment observed.
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	Good.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	One path on d.s. slope leading from roadway at toe to dike crest. No sloughing or erosion observed.
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	Riprap in good condition at and 3 ft above waterline.
Unusual Movement or Cracking at or near Toe	None observed.
Unusual Embankment or Downstream Seepage	Seepage observed at two location, see text.
Piping or Boils	None observed.
Foundation Drainage Features	None observed.
Toe Drains	None observed.
Instrumentation System	None.
Vegetation	Dense on both u.s. and d.s. slopes.

PERIODIC INSPECTION CHECK LIST

PROJECT Overlook Reservoir DATE April 11, 1979

PROJECT FEATURE Intake Structure NAME Ron Cheney

DISCIPLINE Structural Engineer NAME Dan LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	None
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	Stone masonry gate house is also the intake structure.
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	Stone works appears in good condition
Condition of Concrete	Access bridge being replaced. Deck not in place at time of upstream.
Stop Logs and Slots	

PERIODIC INSPECTION CHECKLIST

PROJECT Overlook Reservoir DATE April 11, 1979

PROJECT FEATURE Control Tower NAME Ron Cheney

DISCIPLINE Structural Engineer NAME Dan LaGatta
Geotechnical Engineer

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Control tower and intake building one and the same.
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	None. All valves manually operated.
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT Overlook Reservoir DATE April 11, 1979

PROJECT FEATURE Outlet Works NAME Ron Cheney

DISCIPLINE Structural Engineer
Geotechnical Engineer NAME Dan LaGatta

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	None
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Overlook Reservoir DATE April 11, 1979

PROJECT FEATURE Outlet NAME Ron Cheney

DISCIPLINE Structural Engineer NAME Dan LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Outlet works consist of 3 pipes (two 12" and one 16") exiting from the gatehouse. One 12" and the 16" feed the City Water System. Remaining 12" is main drawdown. Gate to this main draw down located in the gatehouse has not been operated in 20± years. Additional gates located in valve chamber at downstream toe of dam. Draw down gate reported as broken.
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	12" drawdown empties into brook downstream of toe.
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST

PROJECT Overlook Reservoir DATE April 11, 1979 & June 17, 1980

PROJECT FEATURE Spillway NAME Ron Cheney

DISCIPLINE Structural Engineer NAME Dan LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	No separate approach channel for spillway.
a. Approach Channel	Riprapped lined U.S. face of embankment is channel. Some settlement of stone has occurred.
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Stone
b. Weir and Training Walls	b. & c. make-up weir/outlet channel
General Condition of Concrete	Good
Rust or Staining	No rust observed
Spalling	Some spalling on concrete walls
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	Some efflorescence on walls
Drain Holes	None
c. Discharge Channel	Channel and spillway are combined
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Concrete-good
Other Obstructions	None Beyond concrete spillway is 24" underground conduit which discharges in woods approximately 350 feet downstream.

PERIODIC INSPECTION CHECK LIST

PROJECT Overlook Reservoir DATE April 11, 1979

PROJECT FEATURE Service Bridge NAME Ron Chenev

DISCIPLINE Structural Engineer NAME Dan LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	Bridge being replaced. Bridge leads to intake building
Bearings	Stone
Anchor Bolts	Welded steel rods
Bridge Seat	Stone
Longitudinal Members	Steel
Under Side of Deck	No deck-being replaced
Secondary Bracing	Steel
Deck	None-being replaced
Drainage System	None
Railings	Steel
Expansion Joints	None
Paint	Recently-bridge is new
b. Abutment and Piers	
General Condition of Concrete	Stone work appears good
Alignment of Abutment	Good
Approach to Bridge	Good
Condition of Seat and Backwall	Good

APPENDIX B

ENGINEERING DATA

LIST OF ENGINEERING DATA

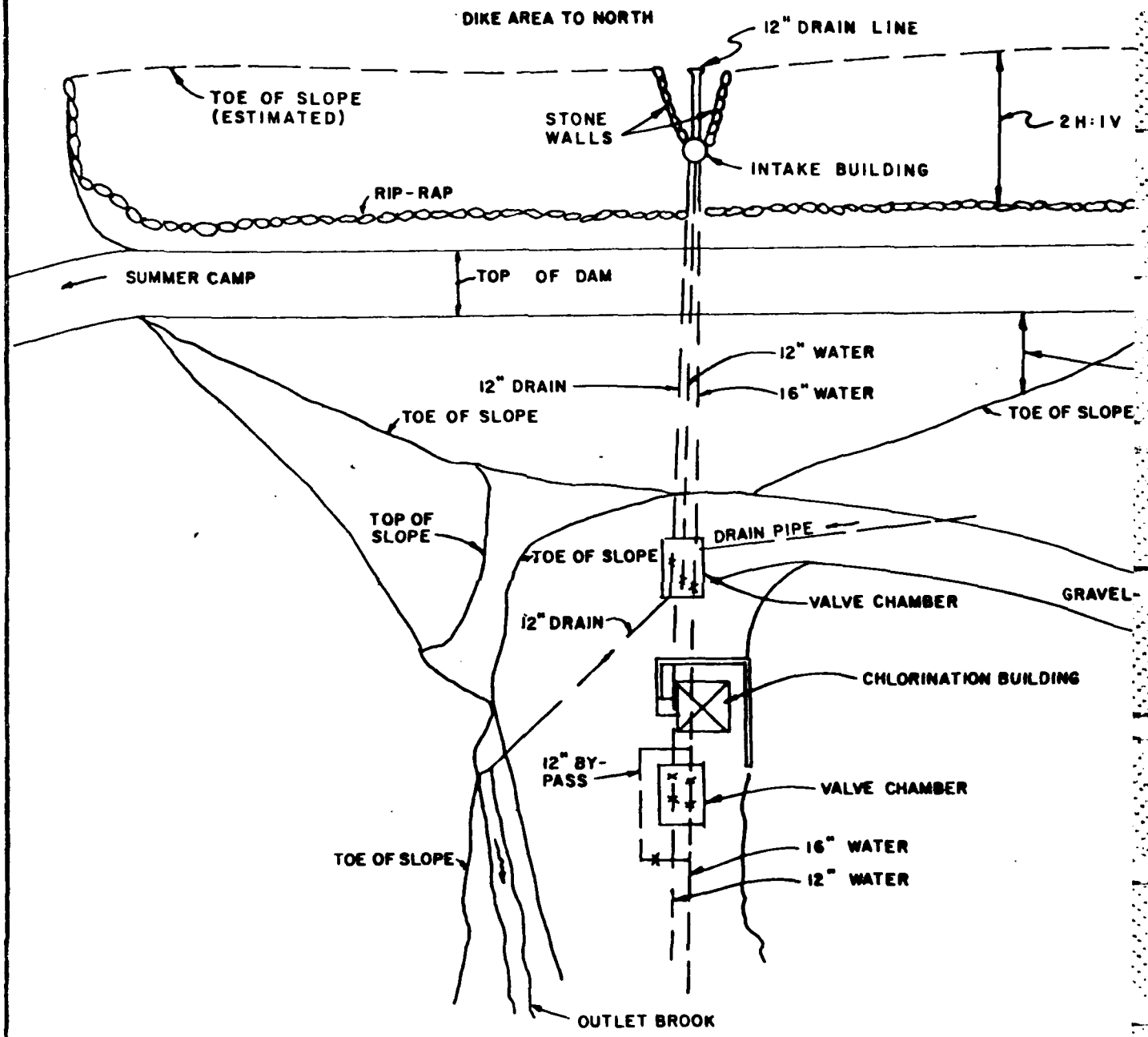
1. Limited Design Plans

2. Post Construction Inspection Reports

Item 1 is available at the City of Fitchburg Engineering Department

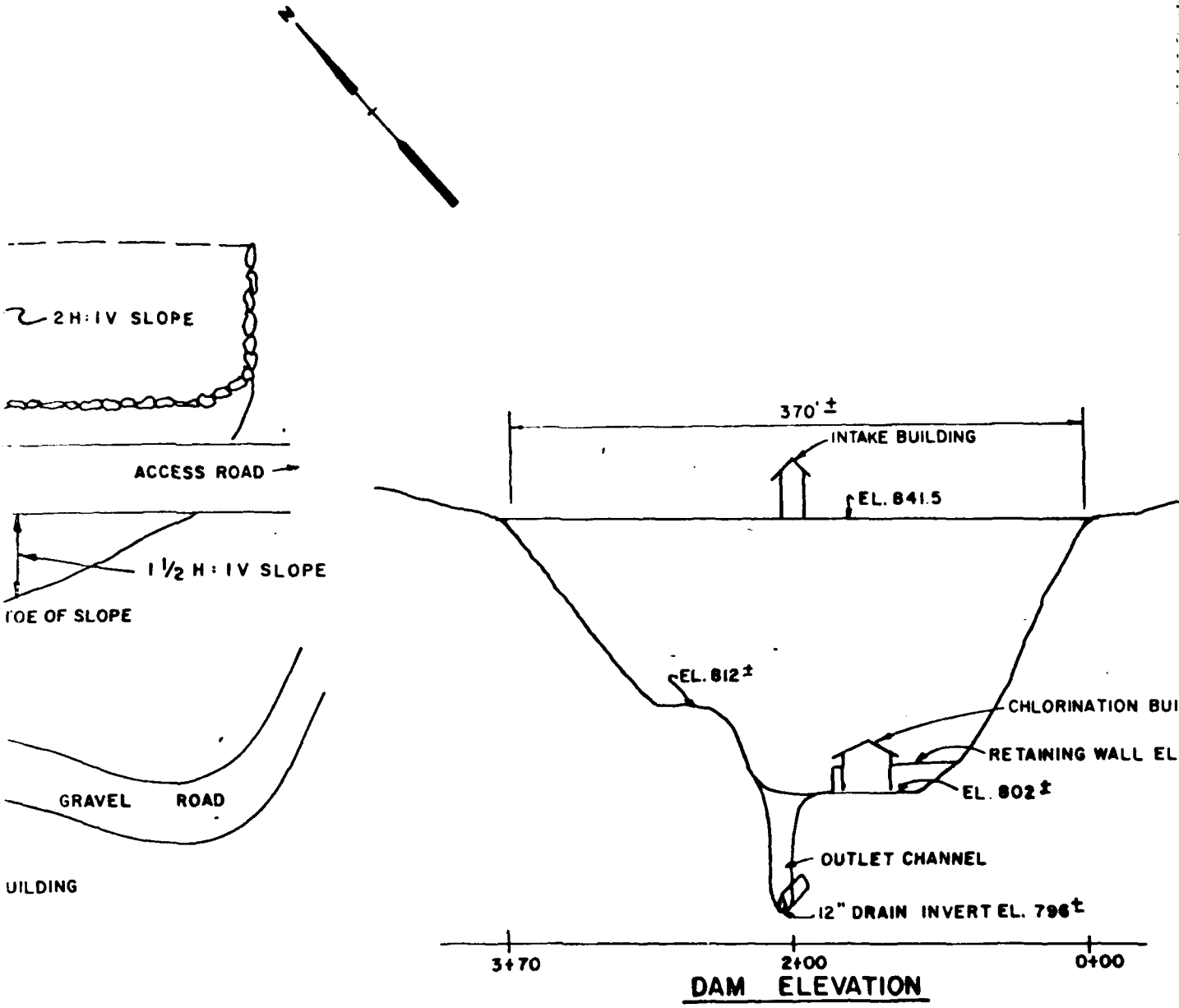
Item 2 is available at:

a. Worcester County Court House Engineering Department
b. Department of Environmental Quality Engineering
   Division of Waterways
   100 Nashua Street
   Boston, Massachusetts 02014



PLAN VIEW

113



DAM ELEVATION

STA. 0+00 = MASONRY WALL ON UPSTREAM SLOPE LEFT ABUTMENT
3+70 = MASONRY WALL ON UPSTREAM SLOPE RIGHT ABUTMENT

PLAN & ELEVATION VIEWS
DEVELOPED FROM RECORD
PLANS & ON-SITE FIELD INSPECTION.

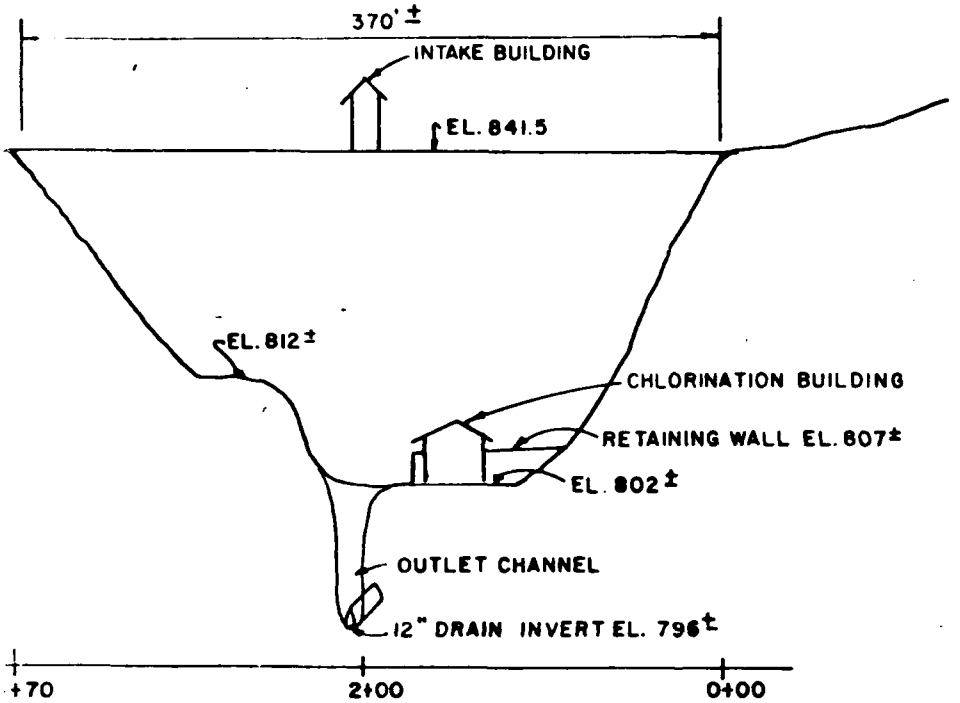
HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGIN CORPS WALT

NATIONAL PROGRAM OF INSPECTION OF

OVERLOOK RESERVC

FITCHBURG

			SCALE: N.T.S.
			DATE: JUNE, 197



DAM ELEVATION

STA. 0+00 = MASONRY WALL ON UPSTREAM SLOPE LEFT ABUTMENT
3+70 = MASONRY WALL ON UPSTREAM SLOPE RIGHT ABUTMENT

HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

VIEWS
ECORD
ELD INSPECTION.

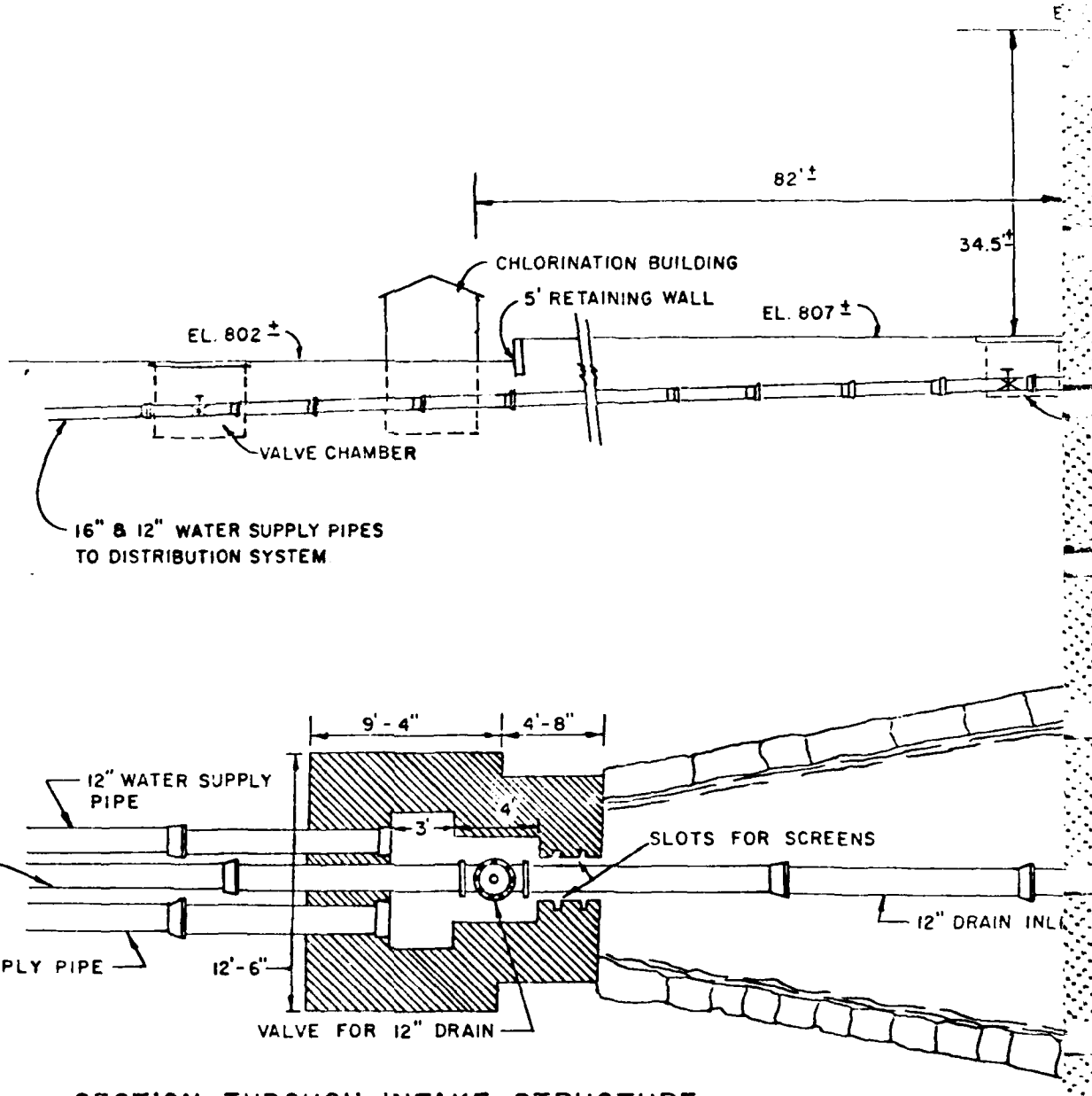
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

OVERLOOK RESERVOIR

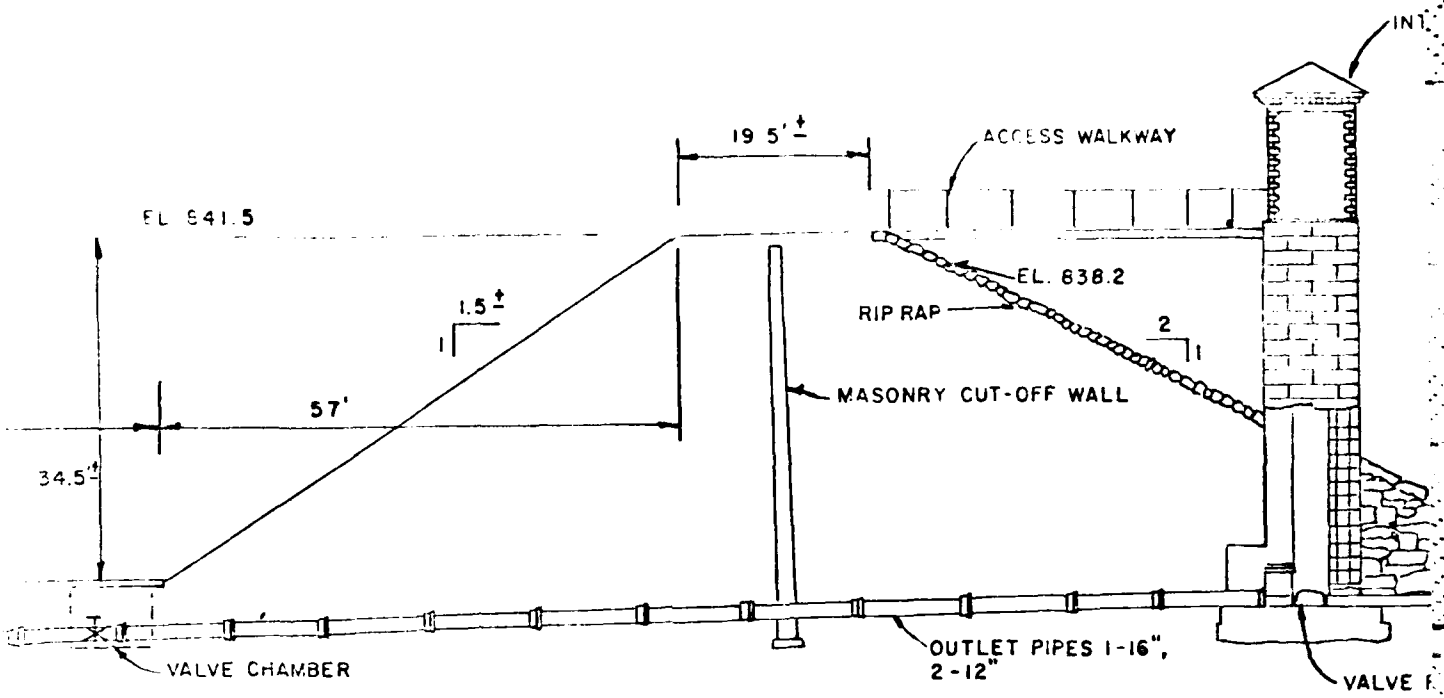
FITCHBURG MASSACHUSETTS

	SCALE: NOT TO SCALE
	DATE: JUNE, 1979

393



SECTION THROUGH INTAKE STRUCTURE



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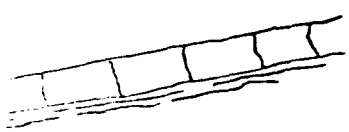
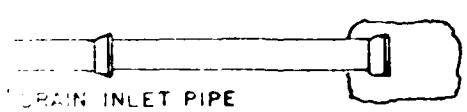




SECTION DEVELOPED F
PLAN AND ONSITE FI

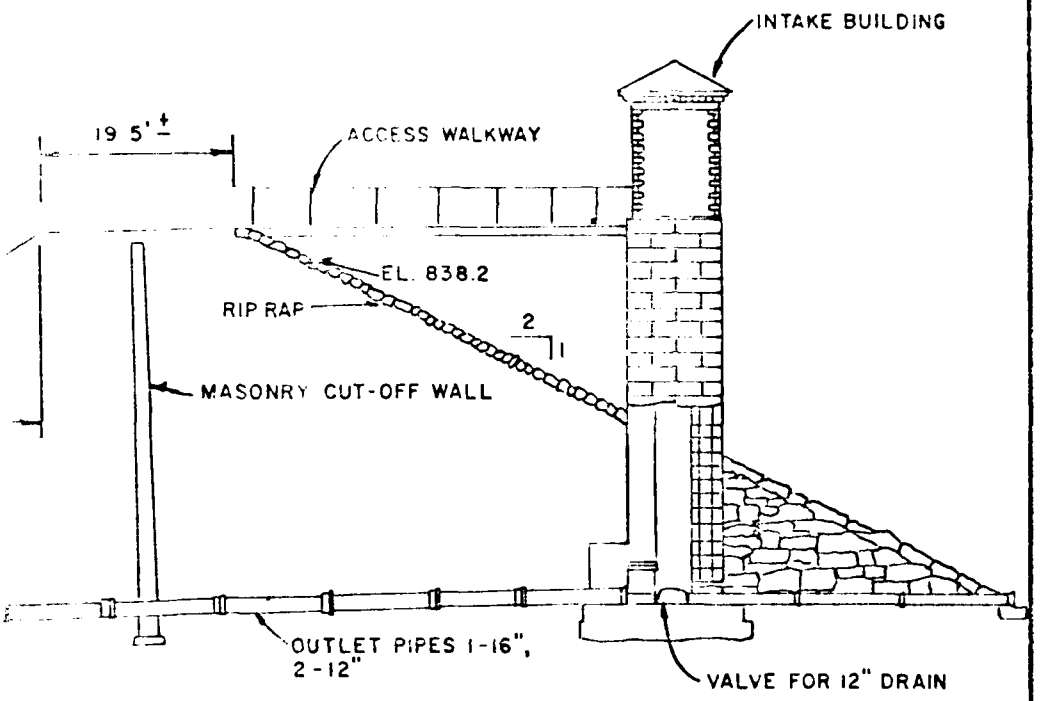
HAYDEN HARDING & BUCHANAN INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U S ARMY ENGINEE CORPS OF BALTIM

NATIONAL PROGRAM OF INSPECTION OF N

OVERLOOK RESERVOI

FITCHBURG MA

			SCALE NOT TO SC
			DATE AUGUST, 19



INTAKE STRUCTURE

SECTION DEVELOPED FROM RECORD PLAN AND ONSITE FIELD INSPECTION

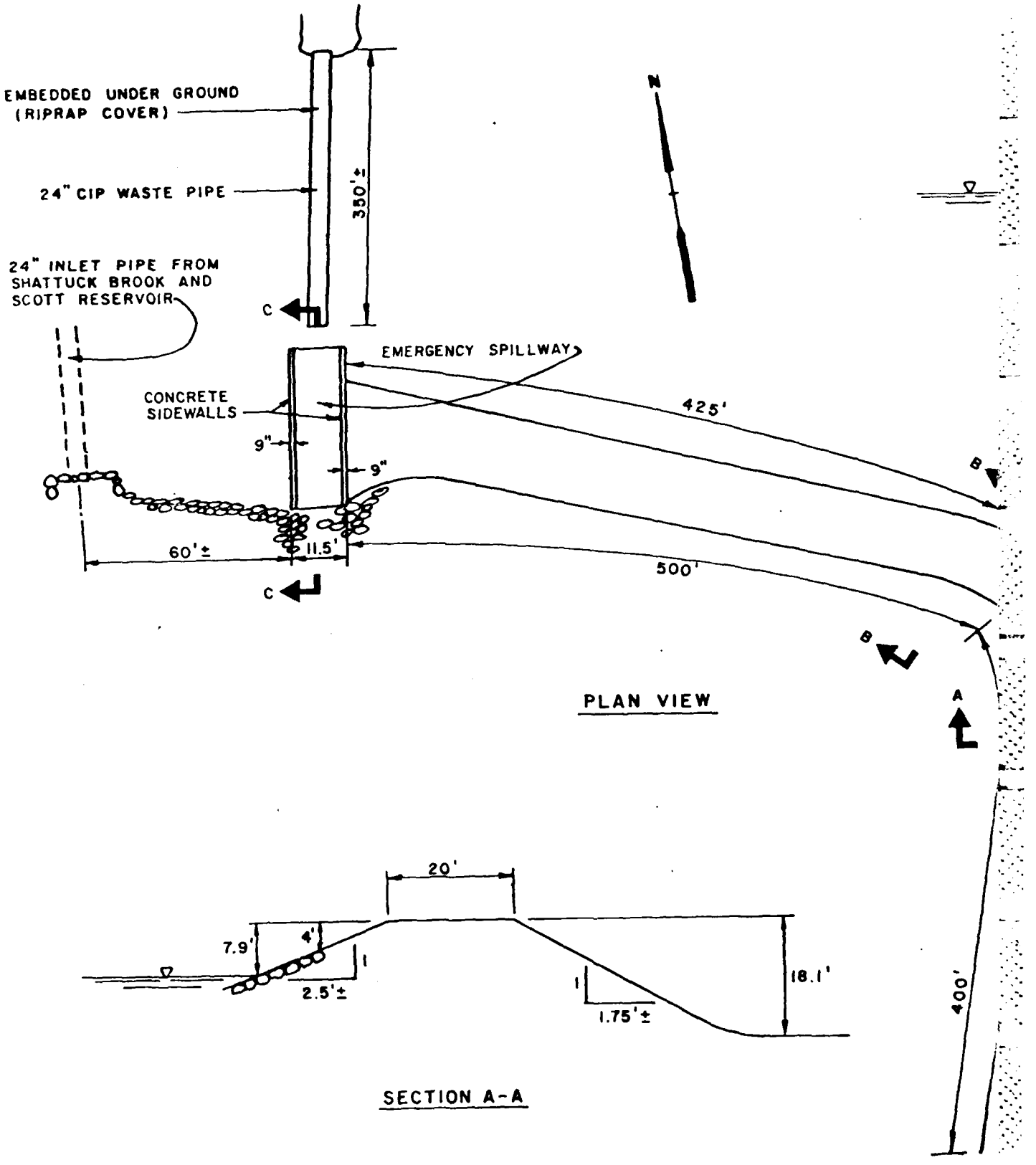
HAYDEN HARDING & BUCHANAN INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

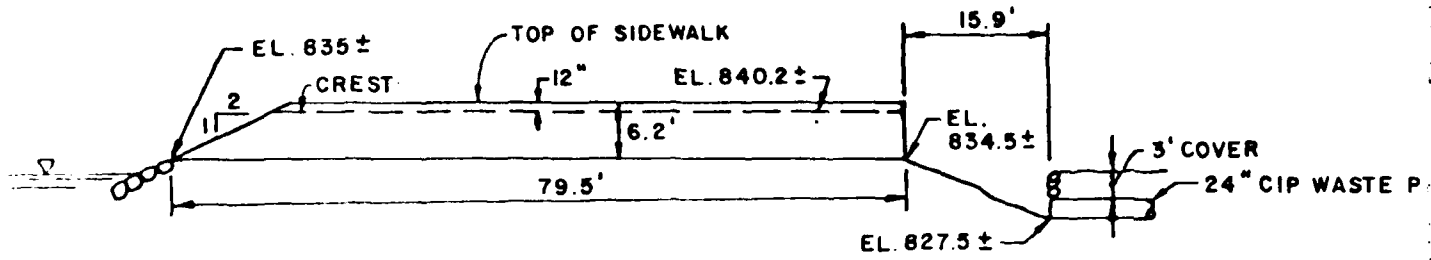
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

OVERLOOK RESERVOIR DAM

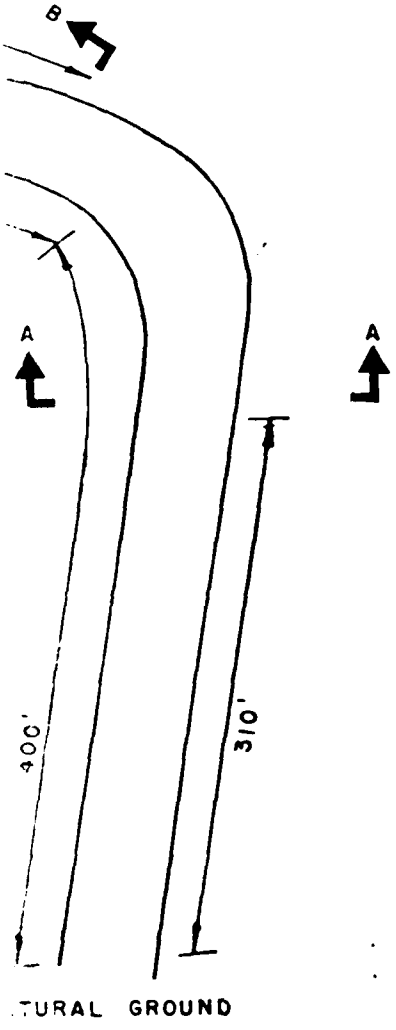
FITCHBURG MASSACHUSETTS

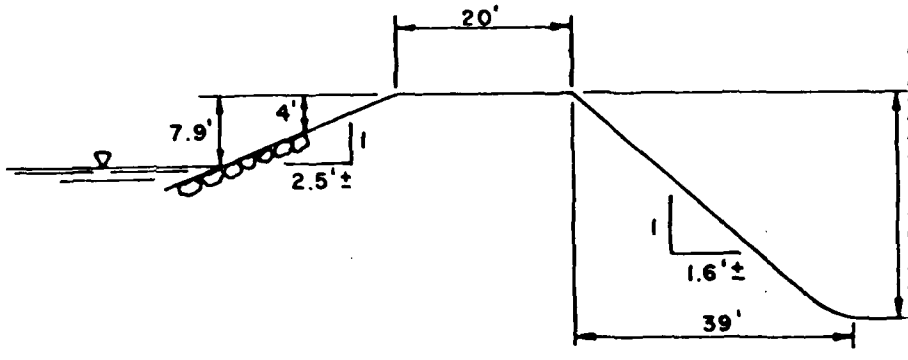
			SCALE NOT TO SCALE
			DATE AUGUST, 1980





SECTION C-C





SECTION B-B

PLAN & ELEVATION VIEWS DEVELOPED FROM JUNE 1980 ON-SITE INSPECTION

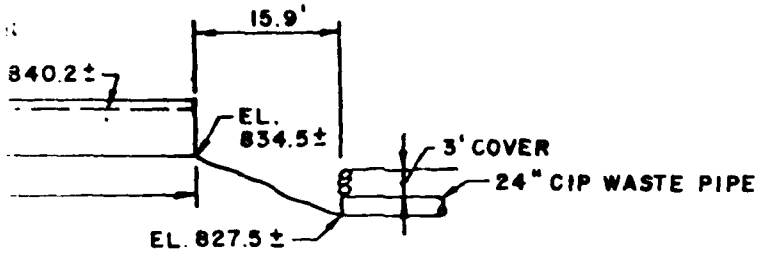
HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S ARMY ENGINEER DI CORPS OF ENGI WALTHAM, M

NATIONAL PROGRAM OF INSPECTION OF NON-

OVERLOOK RESERVOIR D

FITCHBURG MASS.

			SCALE NOT TO SCALE
			DATE JULY, 1980



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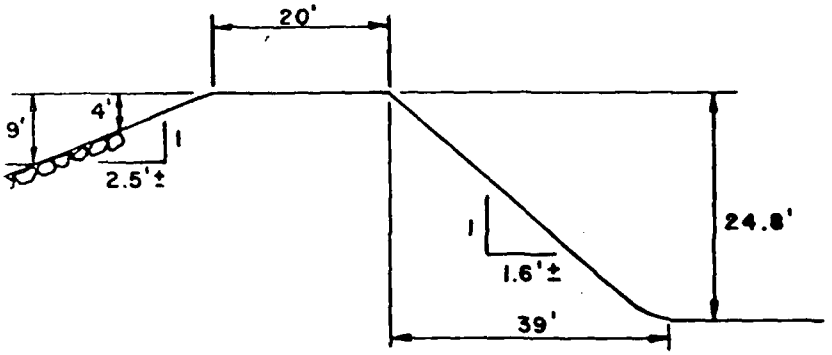


SECTION B-B

HAYDEN, HARDING & BUCHANAN, INC. CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U.S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OVERLOOK RESERVOIR DIKE

FITCHBURG MASSACHUSETTS

			SCALE NOT TO SCALE
			DATE JULY, 1980

12-30-77

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

Department of Environmental Quality Engineering

Division of Waterways

100 Nashua Street, Boston 02114

December 21, 1977

Refer Ernest Bérard

The Honorable Hedley Bray, Mayor
City of Fitchburg
City Hall
718 Main Street
Fitchburg, Mass.

RE: Dam #3-14-97-28 Overlook Reservoir (So. Dyke)
Dam #3-14-97-28.1 Overlook Reservoir Dam
Dam #3-14-97-34 Lovell Reservoir Dam
Dam #3-14-97-37 Scott Reservoir Dam

Dear Mayor Bray:

On February 10 and 24, 1977 you were notified of the unsafe condition of the above referenced dams. You were urged on both occasions to obtain the services of a Registered Professional Engineer. (RPE)

Please advise me by January 6, 1978 the name(s) of the RPE(s) the City has retained to oversee the rehabilitation of these structures.

Provided herewith is a copy of Chapter 253 Sections 44-49 inclusive as amended by Chapter 706 of 1975 of the Massachusetts General Laws that define our jurisdiction and authority should any order not be complied with.

If you have any questions or need assistance in this matter please contact me in Boston.

Sincerely,

For the Commissioner

JOHN J. RAHON, P.E.
CHIEF ENGINEER

EHM:bjm
Encl.
CC: David Standley, Comm.
Gilbert Joly, REE
John J. Lyons, DHE
Willis Regan, Dist. #3
Al McCallum

PUBLIC WORKS DEPT. FITCHBURG, MASS.
DEC 30 11 27 AM '77

DEC 3 1977

MAYOR'S OFFICE

The Commonwealth of Massachusetts

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.
DIVISION OF WATERWAYS

100 Nashua Street, Boston 02114

February 24, 1977

The Honorable Hedley Bray
Mayor, City of Fitchburg
City Hall
718 Main Street
Fitchburg, Mass.

RECEIVED
FEB 28 1977
MA... OFFICE

RE: Letters dated 2.10.77
Insp. Dams #3-14-97.28.1 Overlook Reser. Dam
" " #3-14-97-34 Lovell Reserv. Dam
" " #3-14-97-28 Overlook Reser. (So. Dyke)
" " #3-14-97-37 Scott Reser. Dam

Fitchburg, Mass.

Dear Mayor Bray:

On June 10, 1976, an Engineer from Mass. Department of Public Works made an inspection of the above dams. Our records indicate the owner to be the City of Fitchburg. As a result of these inspections this Division has rated these structures unsafe and has duly notified you of their condition (ltrs. dated 2.10.77 .

We again urge you to obtain the services of a Registered Professional Engineer, experienced in the design, maintenance and construction of dams in order that you may pursue remedy as quickly as possible.

Enclosed is a Department application form which must be completed and returned to this office for review and approval before any major repairs or alterations begin.

Please notify this Division of your intentions or measures in process which will correct this situation.

If we may be of assistance, do not hesitate to contact us. Witn any correspondence, please include the number of the dam as indicated above.

Very truly yours,

JOHN J. HANNON, P.E.
CHIEF ENGINEER

F.DeR.:eh
CC: D.H.E. DIST. #3
D.D.E. " #3
Ernie Giroud, Commr. D.P.W.

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/~~Town~~ Fitchburg Dam No. 3-14-97-28

Name of Dam Overlook Reservoir Inspected by Regan, Rizkalla

Main (South) DIKE Date of Inspection 6/10/76

2. Owner/s: per: Assessors _____ Prev. Inspection ✓

Reg. of Deeds _____ Pers. Contact _____

1. The Hon. Hedley Bray - MAYOR - City Hall - 718 Main St. - Fitchburg
Name Copy To St. & No. City/Town State Tel. No.

2. Ernie Girourd - Comm of Public Works - Fitchburg
Name St. & No. City/Town State Tel, No.

3. _____
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel.No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓

3. Severe ✓ To 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual _____

Operative _____ yes; _____ No.

Comments:

7. Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs ___

Comments: 15'± Eroded Area Just West of Gate House Cat Walk. Remove light growth of brush on U.S. face above RIP RAP

DAM NO. 3-14-97-28

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ✓ 4. Urgent Repairs _____

* Comments: Heavy Growth of Brush on d.s. Slope. Seepage Noted on 5/6/75 Report has Abated, Now Could be described as moderate rather than heavy

9. Emergency Spillway: None - Spillway is located on isolated main Dike (Dam # 28.1)

Condition: 1. Good _____ 2. Minor Repairs _____

3. Major Repairs ____ 4. Urgent Repairs _____

Comments:

10. Water Level at time of inspection: 9½ ft. above ____ below ✓

top of dam Emb. ____ principal spillway ____

other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ✓

Animal Burrows and Washouts —

Damage to slopes or top of dam See (7)

Cracked or Damaged Masonry —

Evidence of Seepage ✓

Evidence of Piping —

Erosion —

Leaks —

Trash and/or debis impeding flow —

Clogged or blocked spillway —

Other —

* Note: Reduction in Seepage flow may be largely due to Reduced upper Pool Elevation.

DAM NO. 3-14-97-28

12. Remarks & Recommendations: (Fully Explain) None of the Conditions Noted on the 5/6/75 Report have been Rectified. Seepage has abated, but this is probably due to the lower Reservoir W.S. Elevation. The Growth of brush is now much heavier and INSPECTION WAS CONSEQUENTLY impeded.

13. Overall Condition: Should be determined by Consultant INSPECTION

1. Safe _____
2. Minor repairs needed _____
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list _____

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/~~Town~~ Fitchburg Dam No. 3-14-97-28

Name of Dam Overlook Reservoir Inspected by REGAN RIZKALLA
MAIN (South) DIKE

Date of Inspection 5/6/75

2. Owner/s: per: Assessors _____ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact ✓

1. The Hon. Hedley Bray - MAYOR City HALL - 718 MAIN St. - Fitchburg, MASS
Name Copy To St. & No. City/Town State Tel. No.

2. George Landes - P.W. Commissioner & City Engineer - City HALL
Name St. & No. City/Town State Tel, No.

3. _____
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel.No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓ _____

3. Severe _____ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓ _____

Operative ✓ yes; _____ No.

Comments: Gated MAIN

7. Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs ___

Comments: More Slope Protection (RIP RAP) needed on the 15' stretch of the U.S. face ~~of~~ Just West of the Gate House Cat WALK

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓

3. Major Repairs To ✓ 4. Urgent Repairs _____

Comments: Brush on D.S. Face 30'x30'x30' Seepage Δ 60'± West of Chlorination Building @ Toe of Slope. Light Flow Visible From This. For other remarks Relative to Seepage See (12)

9. Emergency Spillway: None - Spillway is located on Isolated N.E Dike (See Report on 3-14-97-28.1)

Condition: 1. Good _____ 2. Minor Repairs _____

3. Major Repairs ____ 4. Urgent Repairs _____

Comments:

10. Water Level at time of inspection: 6± ft. above ____ below ✓

top of dam Emb. _____ principal spillway _____

other _____

11. Summary of Deficiencies Noted:

a) Growth (Trees and Brush) on Embankment Brush on D.S. Face

b) Animal Burrows and Mashouts / Noted on D.S Face

c) Damage to slopes or top of dam ✓ Make Action Causing Some Deterioration on U.S. FACE Just West of Gate House Catwalk

d) Cracked or Damaged Masonry —

e) Evidence of Seepage ✓

f) Evidence of Piping —

g) Erosion See c)

h) Leaks —

i) Trash and/or debis impeding flow —

j) Clogged or blocked spillway —

k) Other —

12. Remarks & Recommendations: (Fully Explain)

There is Fairly Heavy Seepage Through This dam. I was Told by people at the Fitchburg Water dept That it was necessary to place a Gravel Pad adjacent to the pumphouse in order to have access To This Area, as This area (@ the d.s Toe) had become Saturated. Toe drainage Flows out of the d.s. End of This Pad Through 2 8" pipes Flowing Full. In addition To this there is the Seepage Area described in (8). A mitigating factor here is that (as per water dept people) This Seepage is of long duration, and the dam has been Standing for 100 years.

However, The Seepage Flow has ~~never~~ Not been metered In ~~the~~ Recent memory (as per the same sources) it is Fairly Heavy, and the downstream hazard is at least Moderate.

On This basis I feel that a Consultant inspection is desirable.

13. Overall Condition:

1. Safe _____
2. Minor repairs needed, At least Inspection by Consultant desirable
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT 3

Submitted by W. REGAN Dam No. 3-14-97-28

Date 5/30/75 City/~~Town~~ Fitchburg

Name of Dam Overlook Reservoir
MAIN (South) DIKE

1. Location: Topo Sheet No. 19D

Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1872 Year/s of subsequent repairs N/A

3. Purpose of Dam: Water Supply ✓ Recreational _____

Irrigation _____ Other _____

4. Drainage Area: 0.15 sq. mi. _____ acres

5. Normal Ponding Area: 13± acres; Ave. depth _____

Impoundment: 50 Million gals.; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir
1 Summer Camp i.e. summer homes, etc. + 1 City Chlorination Plant

7. Dimensions of Dam: Length 270'± Max. Height 30'±

Slopes: Upstream Face 2:1

Downstream Face 2:1

Width across top 20'±

* Information regarding Possible Presence of a Conc. Core Wall Not Available

8. Classification of Dam by Material:

Earth ✓ Conc.* Masonry See Note Above Stone Masonry Gate House

Timber _____ Rockfill _____ Other Rip Rap U.S. Face

9. A. Description of present land usage downstream of dam:

70 % ~~rural~~ Residential + Rural; 30 % urban.

B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes _____ no ✓

DAM NO. 3-14-97-28

10. Risk to life and property in event of complete failure.

See Note Below

No. of people _____.

No. of homes _____.

No. of Businesses _____.

No. of industries _____. Type _____

No. of utilities _____. Type _____

Railroads _____.

Other dams _____.

Other _____.

11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

12. How to Locate:

W.B. ON Rte. 2A - 31 overlap (MainSt.) Bear Rt on MAIN St. where the Numbered Rte Bear Left to Cross the N. Nashua River. Travel to Caldwell St. & ~~Turn~~ Rt. Travel to the Point where Caldwell St. is now dead Ended (Adjacent to the Marshall Reservoir). There is a dirt Road just S. of the MARSHALL Res. which leads to the Overlook Reservoir MAIN Dike.

Note (a): Before Reaching The N. NASHUA River discharge is a Threat To life & Property at The Following:

① 3 Residences (multi family)

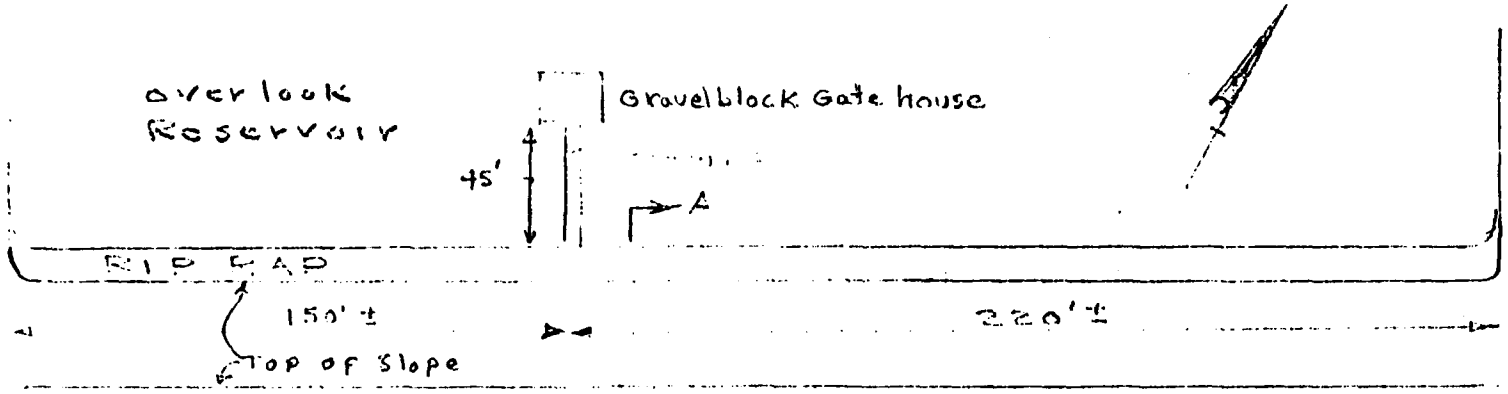
② 1 Church.

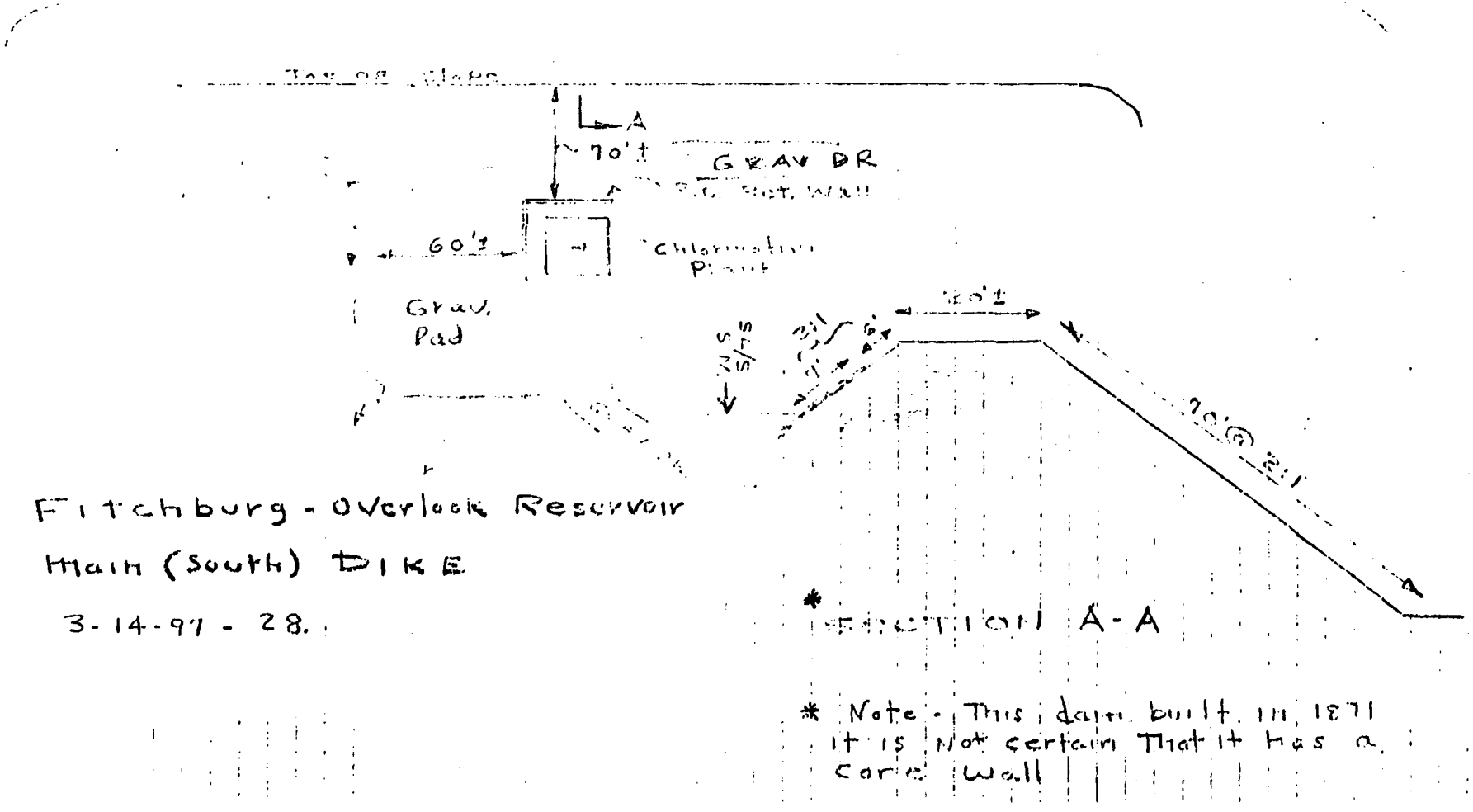
It is a threat to property at the following:

① It would WASH out 1 Road Crossing (and the Associated Utilities)

② It would probably Cause FOUNDATION Flooding of 2 small Buildings

③ It is a possible threat to Property DOWNSTREAM on the N. NASHUA





Fitchburg - Overlook Reservoir

Main (South) DIKE

3-14-97 - 28.

TOWN Fitchburg DAM NO. 16-28

LOCATION 1400' southerly - Flat Rock Rd. STREAM -

- On a Private Road. Overlook Reservoir

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg Place Water Dept. Use Water Supp.

Inspected by WOL. Date Oct. 20 1964

Type of Dam Earth dam Condition Good

SPILLWAY

Flashboards in Place _____ Recent Repairs _____

Condition No spillway

Repairs Needed (The deed says that the land area is 26.84 acres and the pond area is 13.65 acres.)

EMBANKMENT

Recent Repairs The brush has recently been cut on this embankme

Condition There is a roadway on top of this dam.

Repairs Needed _____

GATES

Recent Repairs _____

Condition The gate is located in a locked granite stone

Repairs Needed gate-house.

LEAKS

How Serious No leaks.

DATE: _____ County Engineer

TOWN Fitchburg DAM NO. 16-2

LOCATION Overlook Res. STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY City of Fitchburg PLACE ~~Drinkin~~ USE Water

INSPECTED BY Corcoran DATE Apr 2, 1958

TYPE OF DAM Earthen CONDITION Good

SPILLWAY

FLASHBOARDS IN PLACE None RECENT REPAIRS

CONDITION Good ½" water over spillway

REPAIRS NEEDED

EMBANKMENT

RECENT REPAIRS

CONDITION Good

REPAIRS NEEDED

GATES

RECENT REPAIRS

CONDITION Good

REPAIRS NEEDED

LEAKS

HOW SERIOUS

DATE

COUNTY ENGINEER

TOWN Fitchburg DAM NO. 18-2

LOCATION Overlook Res. STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Fitchburg Water Dept. PLACE Fitchburg USE High level reservoir

INSPECTED BY Joe Pierce L.O.Marden DATE Jan.14,1949

TYPE OF DAM Earth reservoir.masonry CONDITION good

SPILLWAY

FLASHBOARDS IN PLACE - RECENT REPAIRS -

CONDITION -

REPAIRS NEEDED none

EMBANKMENT

RECENT REPAIRS none

CONDITION good

REPAIRS NEEDED none

GATES

RECENT REPAIRS none

CONDITION Mr. Pierce says OK

REPAIRS NEEDED none

LEAKS

HOW SERIOUS none visible

DATE

B-19

COUNTY ENGINEER

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L. O.M. & A. W. F. Brown Date Feb. 23, 1933 Dam No. 16-28

Town Fitchburg Location Overlook Reservoir.

Owner Fitchburg Water Dept. Use

Material and Type

Dam Designed by Phineas Ball-Worc. Constructed by Geo. Norman Year 1872

SPILLWAY—Length Feet. Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition None. 40' water at dam.

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition O. K.

GATES Location

Size Kind El. Flowline

Condition O. K.

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure Small seepage at north end. Not dangerous.
Small seepage at slope downstream face dam.

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet B-20

Decree No. ..... Dam No. 16-28

(5)

COUNTY OF WORCESTER, MASSACHUSETTS
OFFICE OF COUNTY ENGINEER

Neg. Nos. .....

INSPECTION OF DAMS, RESERVOIR DAMS AND RESERVOIRS

Town Fitchburg Date Oct. 17, 1924 Dam No. .....

Location Aml. N.W. Common Name of Pond or Stream Over look Res.

Inspected by L.O.Marden

Owner City of Fitchburg Use .....

MATERIAL & TYPE Earthern Embankment

Elevations in feet: above (+) or below (−) full pond or reservoir level.

FOR DAM Bed of stream below ..... top of spillway .....

FOR RESERVOIR

top of dam 100 top of flashboards ..... ground surface below 80

..... level of overflow pipe ..... length in feet 300

width top in feet ..... width bottom in feet ..... size pipe to mill .....

..... inches ..... length spillway in feet ..... head in feet .....

Size of wheel ..... H. P. developed .....

Size of gates ..... location of gates .....

Foundation and details of construction Rocky soil

..... condition of embankment good

Constructed by ..... date .....

Designed by ..... location .....

Recent repairs and date none

Evidence of leakage none

Condition good

Topography of country below .....

Nature of buildings and roads below dam .....

.....

No. Acres in watershed ..... No. Acres in pond .....

Plans secured ..... Percent watershed in cultivation .....

Percent in forests ..... Note: Cross out word not applicable .....

.....

.....

.....

.....

.....

B-21

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/~~Town~~ Fitchburg Dam No. 3-14-71-291

Name of Dam Overlook Reservoir Inspected by Regan, Rizkalla

Emergency (Northeast) Dike

Date of Inspection 6-10-76

2. Owner/s: per: Assessors _____ Prev. Inspection ✓

Reg. of Deeds _____ Pers. Contact _____

1. The Hon. Hedley Gray - Mayor. City Hall - 718 Main St. - Fitchburg
Name St. & No. City/Town State Tel. No.

2. _____
Name St. & No. City/Town State Tel, No.

3. _____
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel.No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓

3. Severe ✓ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓

Operative ✓ yes; _____ No.

Comments: GATED MAINS

7. Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs ___

Comments: REMOVE BRUSH

DAM NO. 3-14-97-281

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓ To

3. Major Repairs ✓ 4. Urgent Repairs _____

Comments: Remove heavy growth of Trees & brush
Moderate Seepage @ Numerous Locations Along
Principal Toe of Slope

9. ~~Emergency~~ Spillway:

Condition: 1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs _____

Comments: Minor Spalling Top of North
CheekWALL

10. Water Level at time of inspection: 1½± ft. above ___ below ✓

top of dam _____ principal spillway INVERT

other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment Very Heavy - D.S. FACE

~~Animal Burrows and~~ Washouts Erosion adjacent To D.S. End
of North CheekWALL

Damage to slopes or top of dam _____

Cracked or Damaged Masonry —

Evidence of Seepage ✓

Evidence of Piping —

Erosion ✓

Leaks —

Trash and/or debis impeding flow —

Clogged or blocked spillway —

Other —

DAM NO. 3-14-97-281

12. Remarks & Recommendations: (Fully Explain)

None of the deficiencies noted in the '75 Report have been Corrected. Leakage at the D.S. is heavier despite Lower Reservoir W.S. Elevation. This dam is in better shape than Lovell and Scott, but a Consultant inspection is still warranted.

13. Overall Condition: Should be determined by in depth Consultant inspection

1. Safe _____
2. Minor repairs needed _____
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list _____

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/~~Town~~ Fitchburg Dam No. 3-14-97-281

Name of Dam Overlook Reservoir Inspected by Regan Rizkalla

Secondary (N.East) DIKE Date of Inspection 5/2/75

2. Owner/s: per: Assessors _____ Prev. Inspection _____

Reg. of Deeds _____ Pers. Contact ✓

1. The Hon Hedley Gray. MAYOR - City Hall - 718 Main St. - Fitchburg. MASS
   Name Copy To St. & No. City/Town State Tel. No.
2. George LANIDES P.W. Commissioner & City Engineer - City Hall
   Name St. & No. City/Town State Tel, No.
3. _____
   Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel.No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓

3. Severe ✓ To 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓

Operative ✓ yes; _____ No.

Comments: Gated MAINS

7. Upstream Face of Dam: Condition:

1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs ___

Comments: Remove Brush

DAM NO. 3-14-97-281

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓

3. Major Repairs ✓ 4. Urgent Repairs _____

Comments: Remove heavy Growth of Trees & Brush - Seepage IN Evidence Along Toe of Slope - Numerous locations

9. Emergency Spillway:

Condition: 1. Good ✓ To 2. Minor Repairs ✓

3. Major Repairs ___ 4. Urgent Repairs _____

Comments: Spalled ~~Concrete~~ Gunite Face - Top Center of N. Spillway Sidewall otherwise Spillway is in good Cond.

10. Water Level at time of inspection: 8± ft. above ___ below ✓

top of dam Emb. _____ principal spillway _____

other 3"± below Spillway Invert

11. Summary of Deficiencies Noted:

A) Growth (Trees and Brush) on Embankment ✓

B) ~~Animal Burrows~~ and Washouts Erosion adjacent To d.s. End Back of South Sidewall of Spillway

C) Damage to slopes or top of dam —

D) Cracked or Damaged Masonry See (9)

E) Evidence of Seepage ✓

F) Evidence of Piping —

G) Erosion See 11 B Above

H) Leaks —

I) Trash and/or debis impeding flow —

J) Clogged or blocked spillway —

K) Other —

DAM NO. 3-14-97-281

12. Remarks & Recommendations: (Fully Explain)

The Seepage Through This dike is of a much Smaller Volume Than That Through # 97-28. and Retention of a Consultant for inspection of This dam is desireable but Not as imperitive As for dam # 97-28.

13. Overall Condition:

1. Safe _____
2. Minor repairs needed ✓ & in depth Insp. desireable
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)
   Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT 3

Submitted by W. REGAN Dam No. 3-14-97-28.1

Date 5/30/75 City/~~Town~~ Fitchburg

Name of Dam Overlook Reservoir
Secondary (Northeast) dike

1. Location: Topo Sheet No. 19D

Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1872 Year/s of subsequent repairs N/A

3. Purpose of Dam: Water Supply ✓ Recreational _____

Irrigation _____ Other _____

4. Drainage Area: 0.15 sq. mi. _____ acres

5. Normal Ponding Area: 13± acres; Ave. depth _____

Impoundment: 50 million gals.; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir
1 Summer Camp i.e. summer homes, etc. & 1 City Chlorination Bldg.

7. Dimensions of Dam: Length 1000'± Max. Height 20'±

Slopes: Upstream Face 2:1

Downstream Face 2:1

Width across top 20'±

8. Classification of Dam by Material:

Earth ✓ Conc. Masonry ✓ Stone Masonry _____

Timber _____ Rockfill _____ Other RIP RAP U.S. FACE

9. A. Description of present land usage downstream of dam:

80 % rural; 20 % urban.

B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes _____ no ✓.

DAM NO. 3-14-97-28.1

10. Risk to life and property in event of complete failure.

See Note Below

- No. of people ______________.
- No. of homes ______________.
- No. of Businesses ______________.
- No. of industries ______________. Type ______________
- No. of utilities ______________. Type ______________
- Railroads ______________.
- Other dams ______________.
- Other ______________.

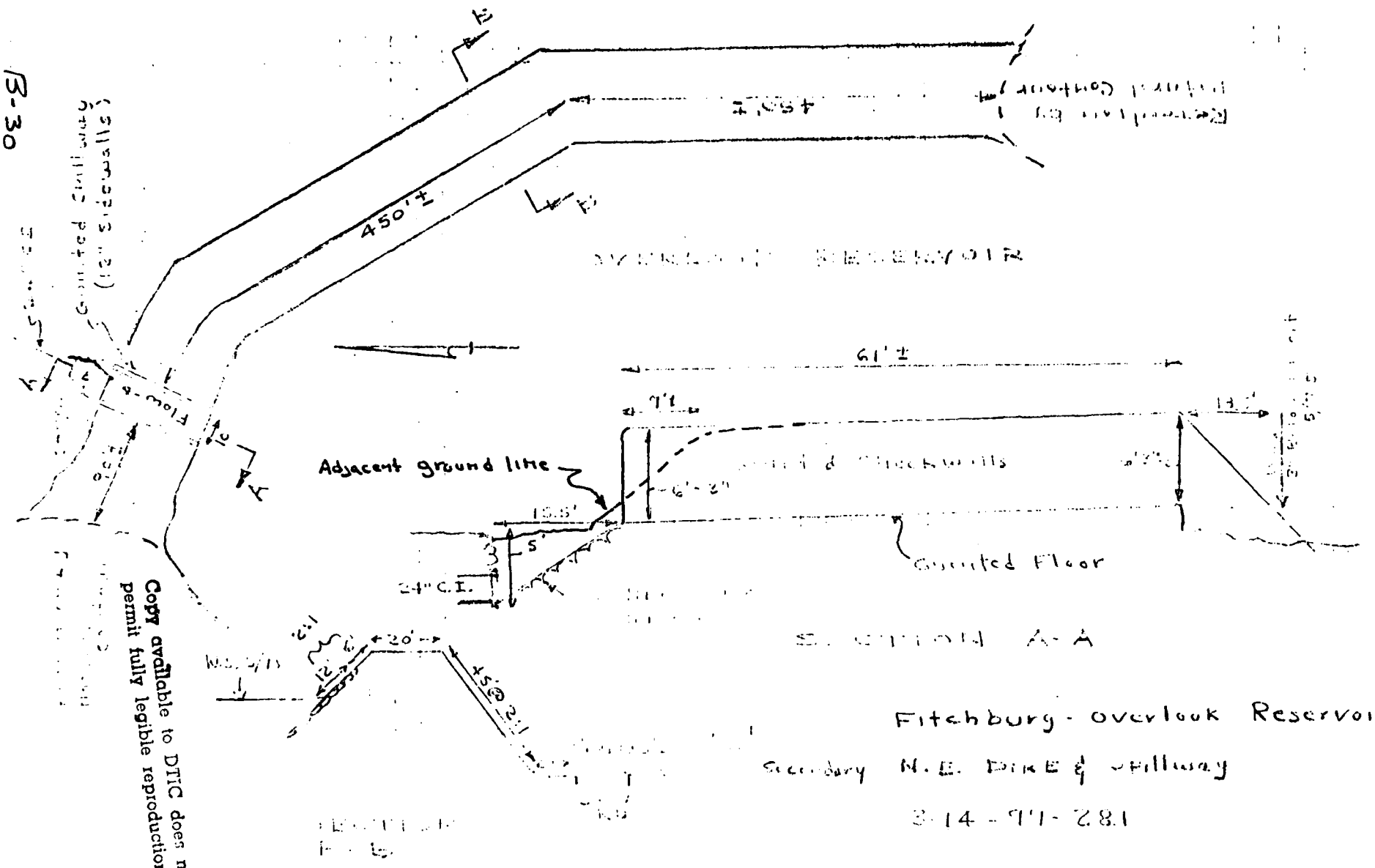
11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

12. How to Locate: ~~N.G.~~ W.G. on The Rte 2A ~~31 overlap~~ (Main St.) Bear Straight Ahead (Where 2A-31 overlap Starts) onto Prospect St. Travel up Prospect To The Prospect St. – Flat Rock Rd (Grav.) intersection. Dam is immediately adjacent to and North of This intersection.

Note (10) Failure discharge Could Take 2 Courses, depending upon Failure locus.

① Discharge would be a Threat To life & Property To at least 2 residences on Prospect St. It would Threaten Numerous other residence @ The Southerly end of Prospect ~~St~~ Street with at least heavy property damage. This would be True at Numerous other residences in a moderately well devel. Area adjacent To the Nashua River, and @ The Southerly end of Prospect St.

② Discharge, Flow down into The Dam No. 77-45.4 U.S Basin, where storage is inadequate, overtop & wash out Burbank [illegible] Flow down To Dam No. 77-45.3, overtop Same, and Then Flow down To a well developed area between Rte 31 and [illegible] where the Threat To Utilities, other proper, Roads [illegible] moderate To [illegible].

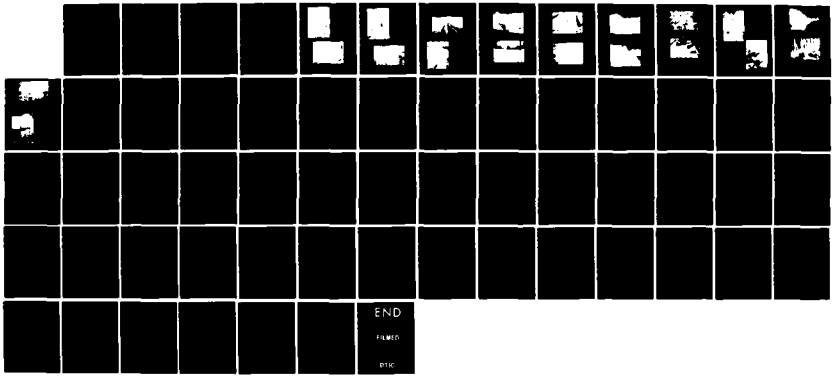


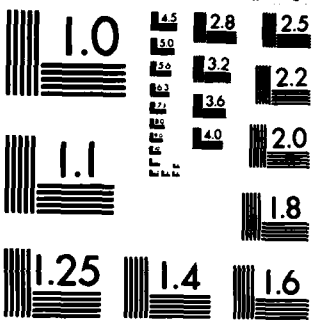
APPENDIX C

PHOTOGRAPHS

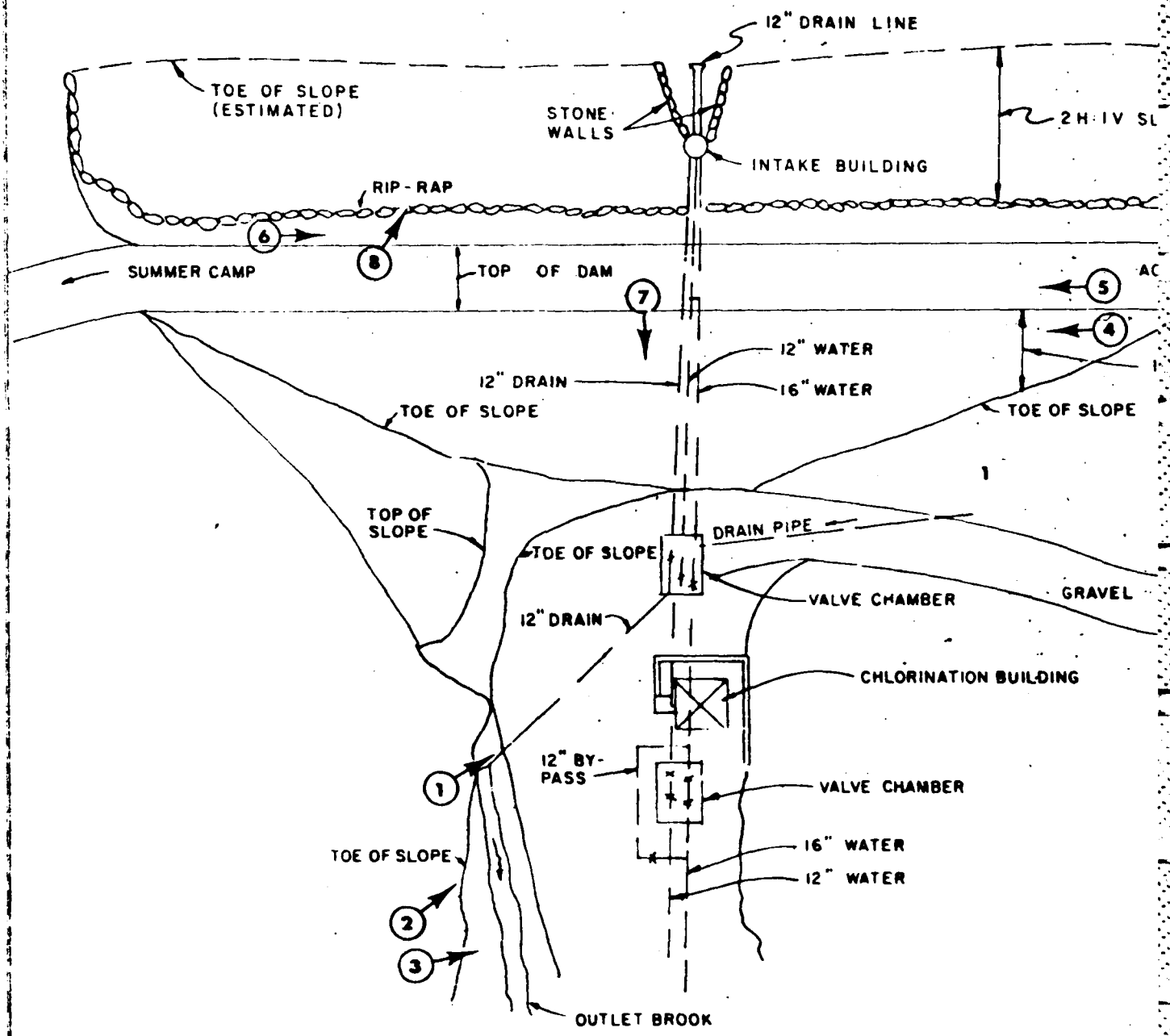
AD-A155 641 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
OVERLOOK RESERVOIR DA.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV AUG 80

UNCLASSIFIED F/G 13/13 NL

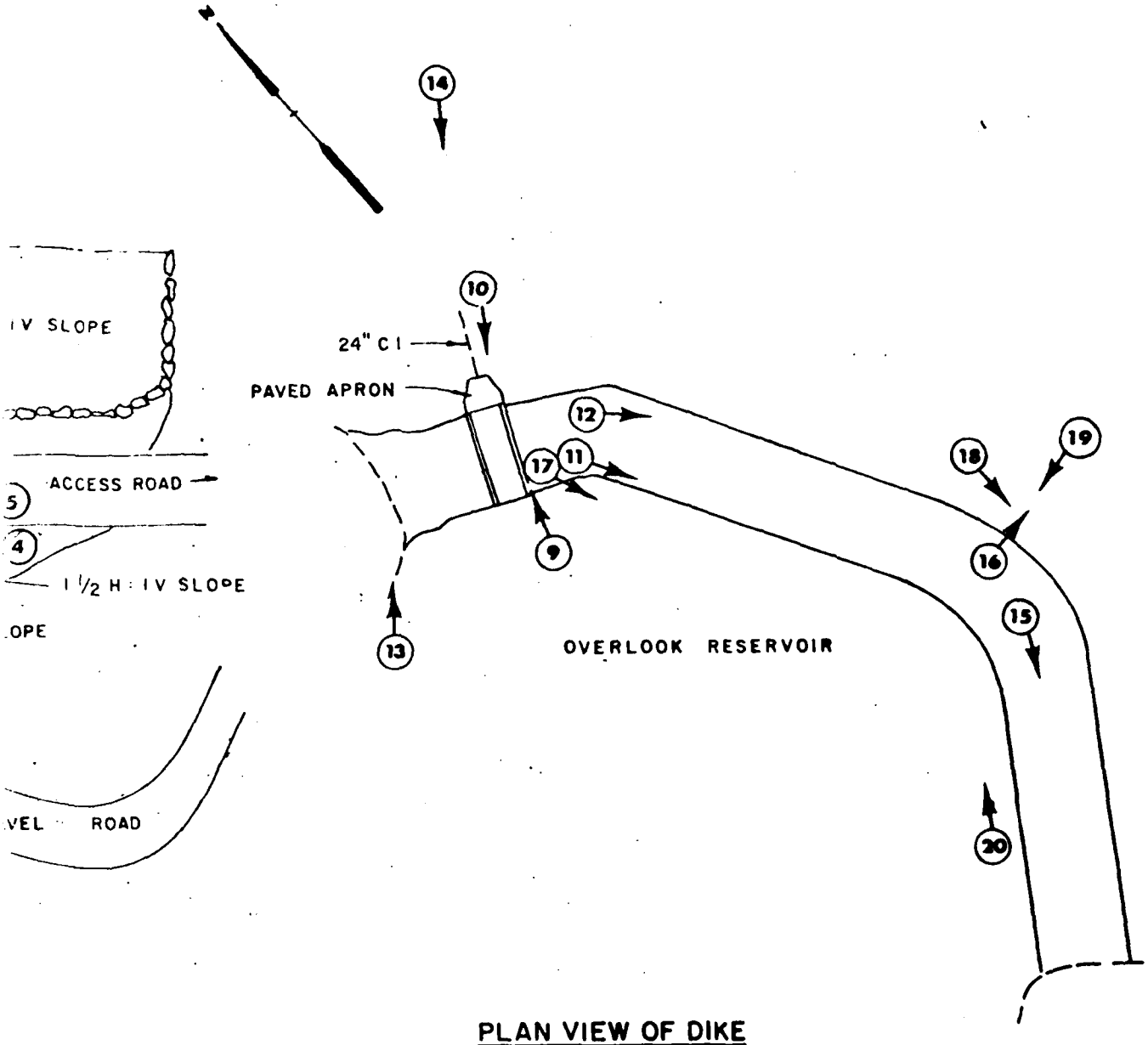




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



PLAN VIEW OF DAM



PLAN VIEW OF DIKE AND SPILLWAY

PLAN & ELEVATION VIEWS DEVELOPED FROM RECORD PLANS & ON-SITE FIELD INSPECTION.

HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U S ARMY ENGINEER DIV N CORPS OF ENGINEE WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-F

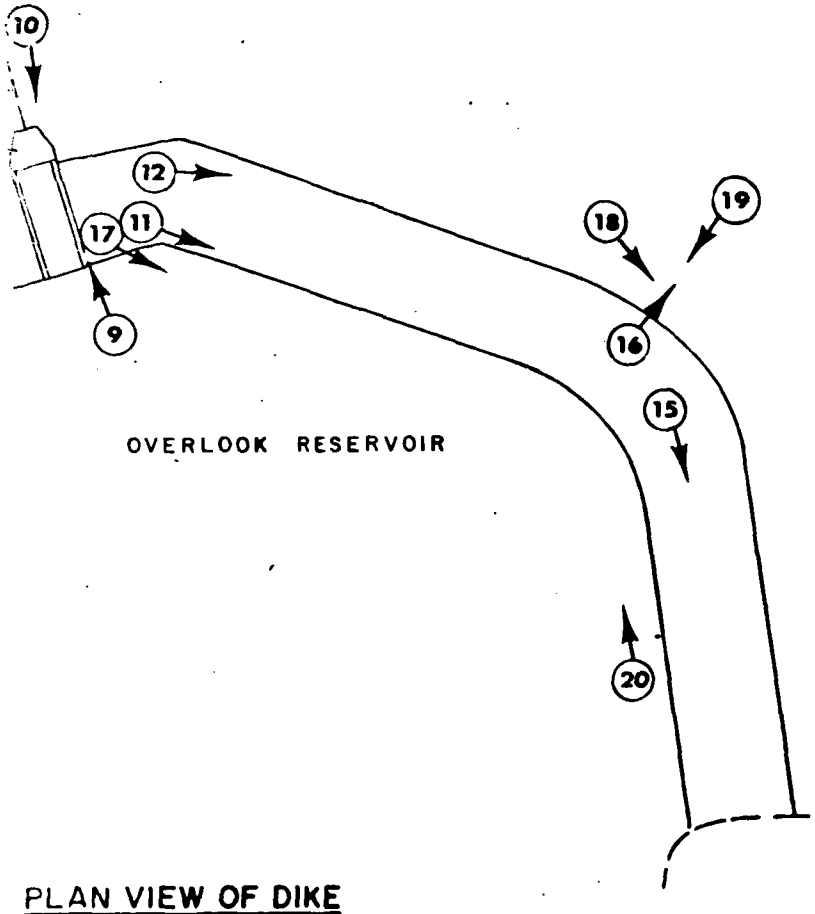
LOCATION OF PHOTOGRAPHS

OVERLOOK RESERVOIR DAM & DIKE

FITCHBURG MASSAC

			SCALE NOT TO SCALE
			DATE JULY 1980

2 of 3



PLAN VIEW OF DIKE
AND SPILLWAY

HAYDEN, HARDING & BUCHANAN, INC CONSULTING ENGINEERS BOSTON, MASSACHUSETTS	U S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LOCATION OF PHOTOGRAPHS

OVERLOOK RESERVOIR
DAM & DIKE

FITCHBURG MASSACHUSETTS

			SCALE NOT TO SCALE
			DATE JULY 1980

NSPECTION.

PHOTO NO. 1 View of 12" diameter pipe discharging clear water into stream, downstream of dam and chlorination building.

PHOTO NO. 2 General view showing location of discharging pipe in Photo No. 1 and spring with respect to the dam seen in background.

PHOTO NO. 3 View of 1 to 2 inch diameter plastic pipes discharging clear water downstream of chlorination building, seen in background.

PHOTO NO. 4 View of downstream face from the left abutment.

PHOTO NO. 5 View of crest and gatehouse from the left abutment.

PHOTO NO. 6 View of upstream slope from the right abutment. Note two types of riprap.

PHOTO NO. 7 Downstream view of toe-of-dam area and outlet channel. Chlorination building is at left of photograph.

PHOTO NO. 8 Upstream view of reservoir area showing dike and spillway.

PHOTO NO. 9 View of spillway showing riprap approach.

PHOTO NO. 10 Twenty-four inch outlet pipe at downstream end of spillway.

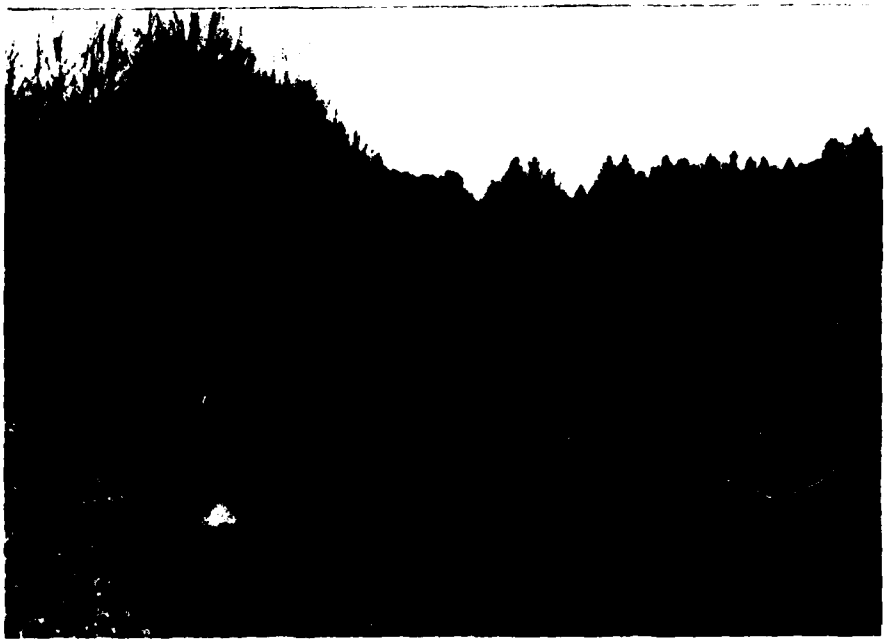


PHOTO NO. 11 Dike area to right side of spillway.

PHOTO NO. 12 View of dike area along access road.

Photo No. 13 Twenty-four inch inlet pipe from Shattuck Brook/Scott Reservoir located to the left of spillway.

Photo No. 14 Outlet for 24 inch pipe shown in Photo No. 10. Outlet is located approximately 350 feet downstream of spillway.

Photo No. 15 Crest of dike from point of curvature to right abutment.

Photo No. 16 Erosion due to trespassing on downstream slope at point of curvature.

Photo No. 17 Upstream slope of dike viewed from spillway toward point of curvature.

Photo No. 18 Downstream slope of dike at midheight viewed from the point of dike curvature toward the right abutment.

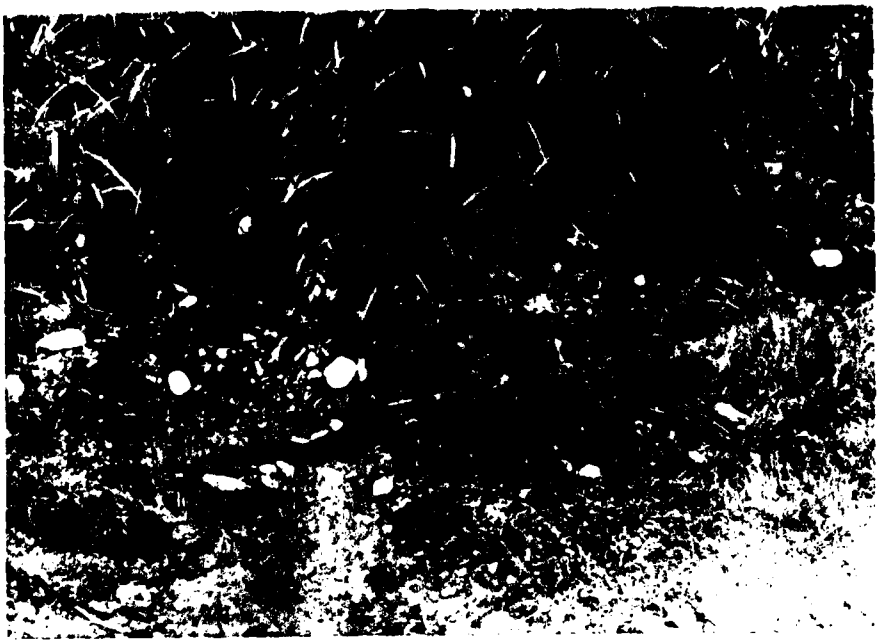


Photo No. 19 Wet area at downstream toe at point of curvature.

Photo No. 20 Riprap on upstream face from right abutment toward point of curvature.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

JOB NO. 78.244.1
DATE 4-5-79
BY MA
CH'D BY PDD 4/23/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 1
JOB Dams
SUBJECT Overlook
CLIENT Corps

OVERLOOK RESERVOIR

Built: 1871 to 1872
Water Supply: varies - small
Surface Area: 10.0 a
Drainage Area: 0.06± sm., 40.±a

Dam Height: 40'±
Storage: 276±a-f
} Size Class: Small

Hazard Potential: High

Test Flood: 1/2 PMF to PMF Range

Use 1/2 PMF

1/2 PMF = 3000 × $\frac{1}{2}$ × 0.0625 = 94.± cfs Inflow
dike spillway can pass 3447 cfs ∴ will pass 100% of Test Flood outflow of 70 cfs at elev. 835.65

Dam Failure Analysis

$$Q_b = \frac{8}{27} \times (0.4 \times 270') \times \sqrt{32.2} \times (40.)^{1.5}$$

Q_b = 45,900.± cfs failure outflow

Damage Due to Failure Outflow

Item	Number	Flood Stage
Pump & Cl_2 Buildings	3	12 to 18'
Roads	3	8' to 18'
Homes	20	8'
Church	1	8'
Mills	3±	8'
playground	1	8'

JOB NO. 78.294.1
DATE 2-5-79
BY MA
CH'D BY FDD 4123179

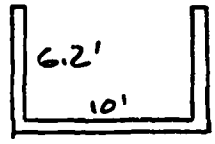
HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON MASSACHUSETTS

SHEET NO. 2
JOB Dams
SUBJECT Overlook
CLIENT Corps

Storage Capacity

Elev		Area	Ave A	D	d-f	Accum Stor
800		1.8	—	—	—	—
830		7.4	4.6	30	138	138.
835.±	"s"	11.2	9.3	5.25	48.8	187.
840.		15.6	13.4	4.75	63.7	251.
841.5	"T"	17.4	16.5	1.5	24.8	276.

Spillway Outflow



$S = 0.025^{ft/ft}$ ± "assumed"

$$V = \frac{1.486}{.015}\left(R^{2/3}\right) S^{1/2} = R^{2/3}(15.7)$$

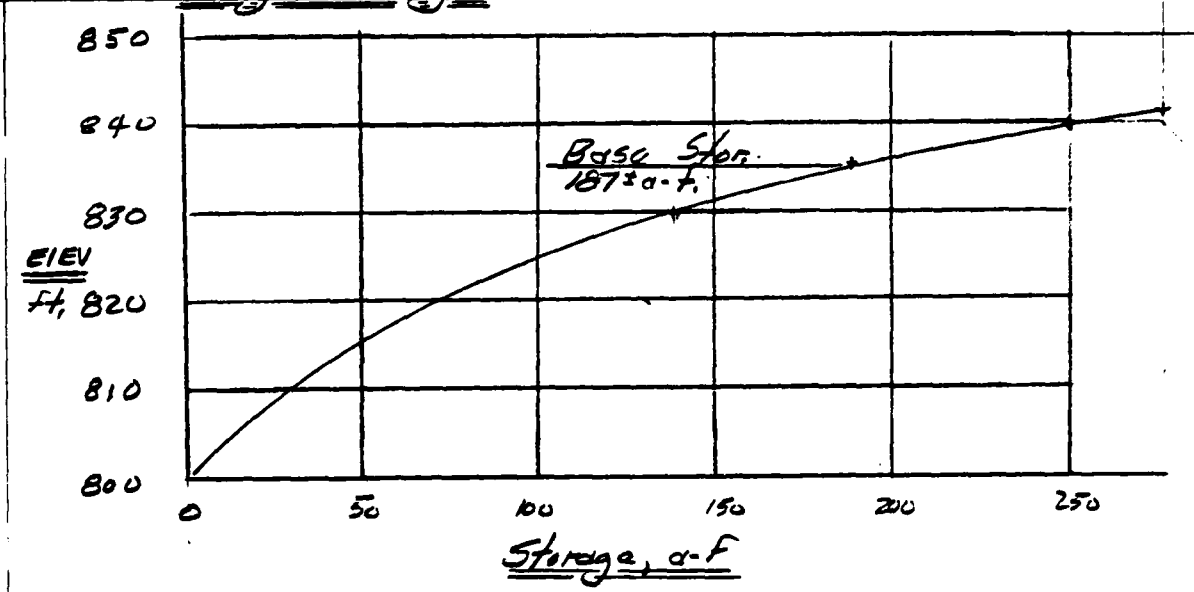
D	WP	A	$R^{2/3}$	F'	V fps	Q cfs
1	12	10	0.89	15.66	13.9	139
2	14	20	1.27	"	19.89	398
3	16	30	1.52	"	23.86	716
4	18	40	—	—	—	—
5	20	50	1.85	"	28.93	1447
6	22	60	1.96	"	30.67	1840 cfs
0.5	11	5	0.59	"	9.23	46

JOB NO. 78,294.1
DATE 9-6-79
BY MA
CH'D BY FDD 4/23/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 3
JOB Dams
SUBJECT Overlooks
CLIENT Corps

Stage Storage

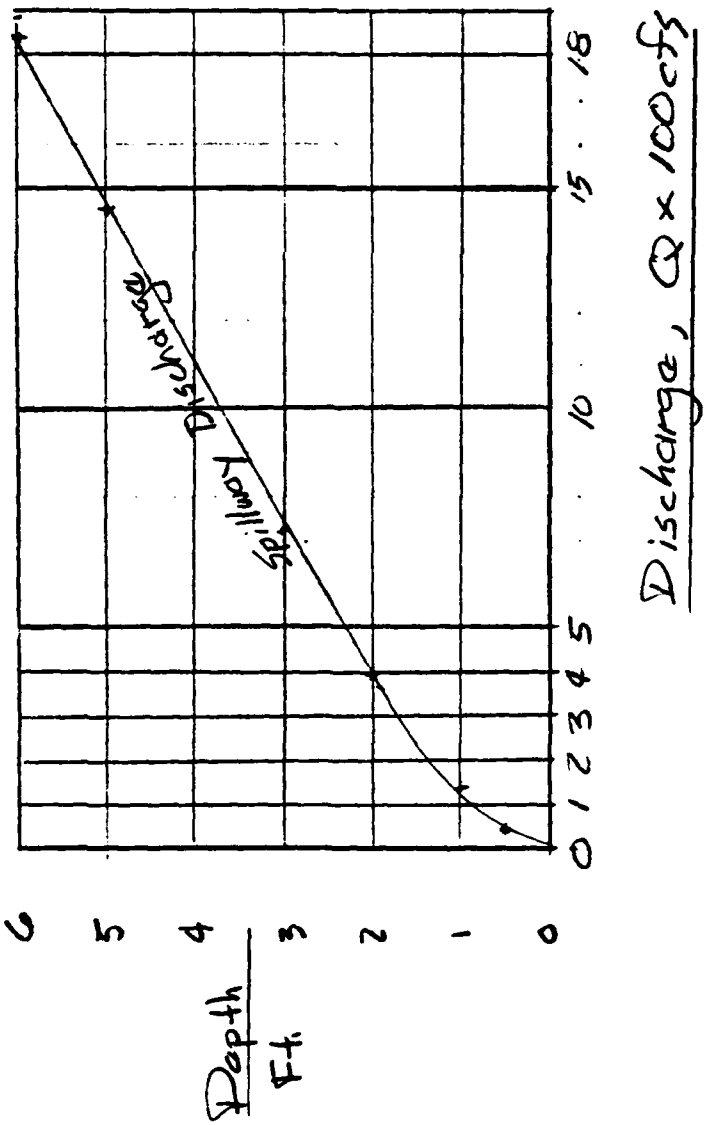


JOB NO. 78.244.1
DATE 6-29-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 4
JOB Dams
SUBJECT Overlook
CLIENT Corps

Stage Discharge



JOB NO. 78.244.1
DATE 4-19-79
BY MA
CH'D BY RDD 4/23/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 5
JOB Dams
SUBJECT Overlook
CLIENT Corps

Test Flood Analysis

Q_{P_1} = Inflow = 94 cfs Elev = 835.75 ±
Stor = 9.7 a-f or 2.7".

$Q_{P_2} = 94\left(1 - \frac{2.7}{9.5}\right) = 67$ cfs $El_2 = 835.6\pm$

$Stor_2 = 7.7\pm$ a-f or 2.15". $Stor_{ovr} = 2.42$"

$Q_{P_3} = 94\left(1 - \frac{2.42}{9.5}\right) = 70$ cfs outflow.

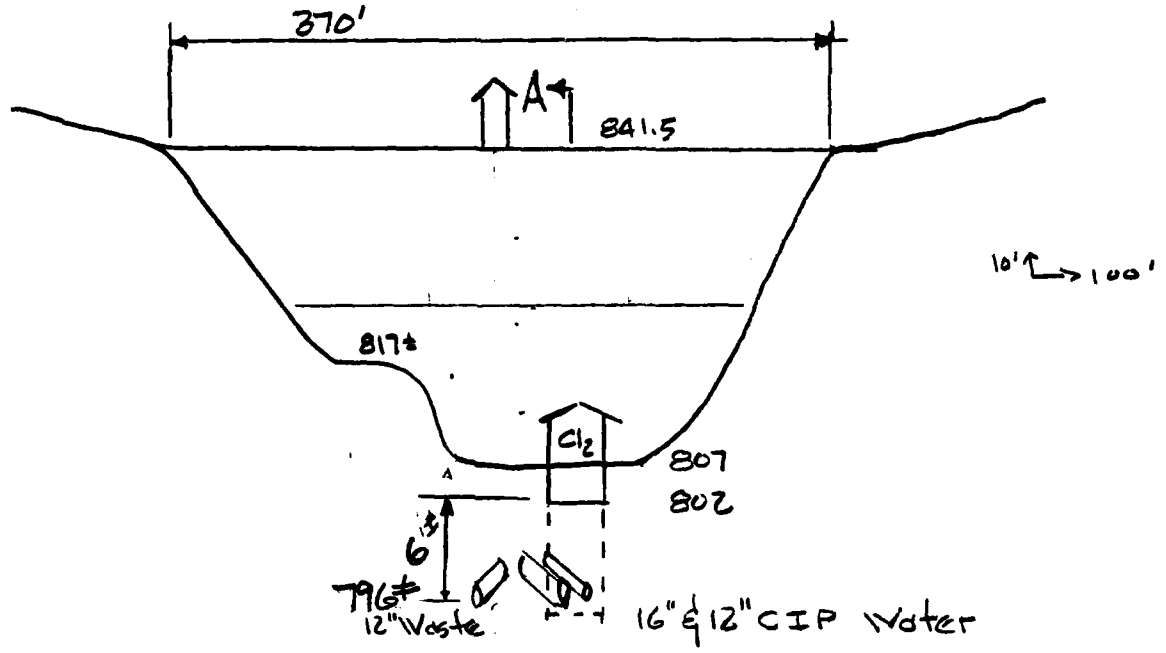
$El_3 = 835.65'\pm$, $Stor_3 = 8.4\pm$ a-f

Tailwater Does not exist at main dam as there is no spillway. Spillway is at dike area. Capacity of 24" CIP at spillway is about 25± cfs. Overland flow here is 45 cfs, depth could be 0.25'± near spillway and less as flow disperses over road & wooded areas.

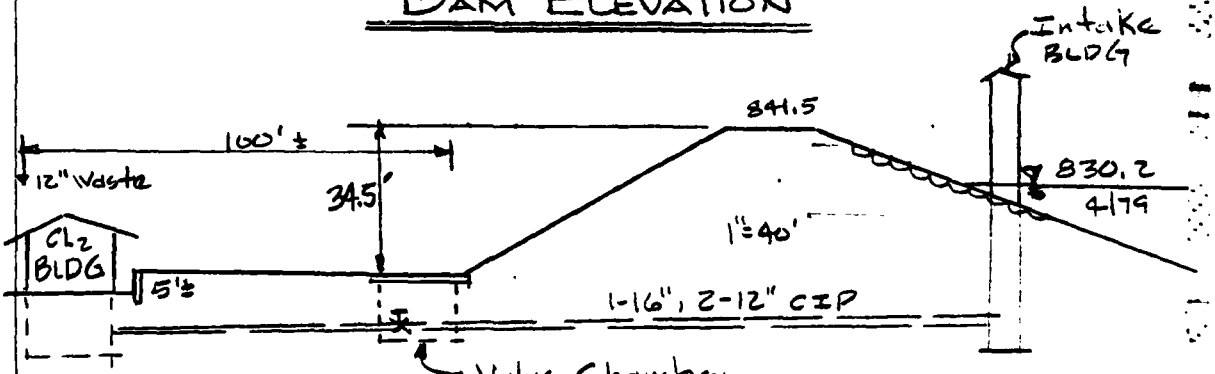
JOB NO. 78,244.1
DATE 4-18-79
BY MA
CH'D BY FDD 4/23/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

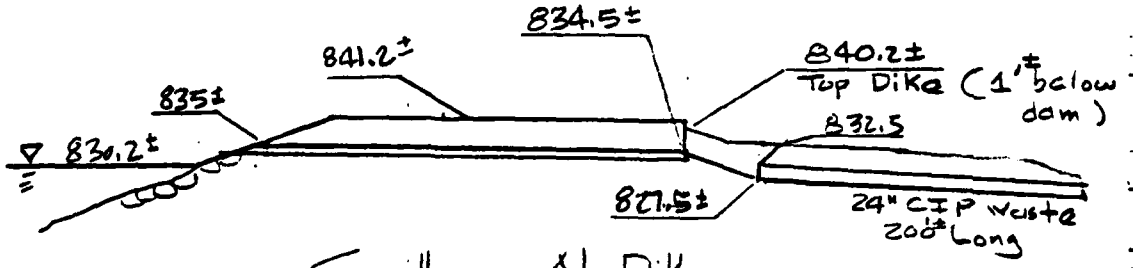
SHEET NO. 6
JOB Dams
SUBJECT Overlook
CLIENT Corps



DAM ELEVATION



SECTION A (40 scale)

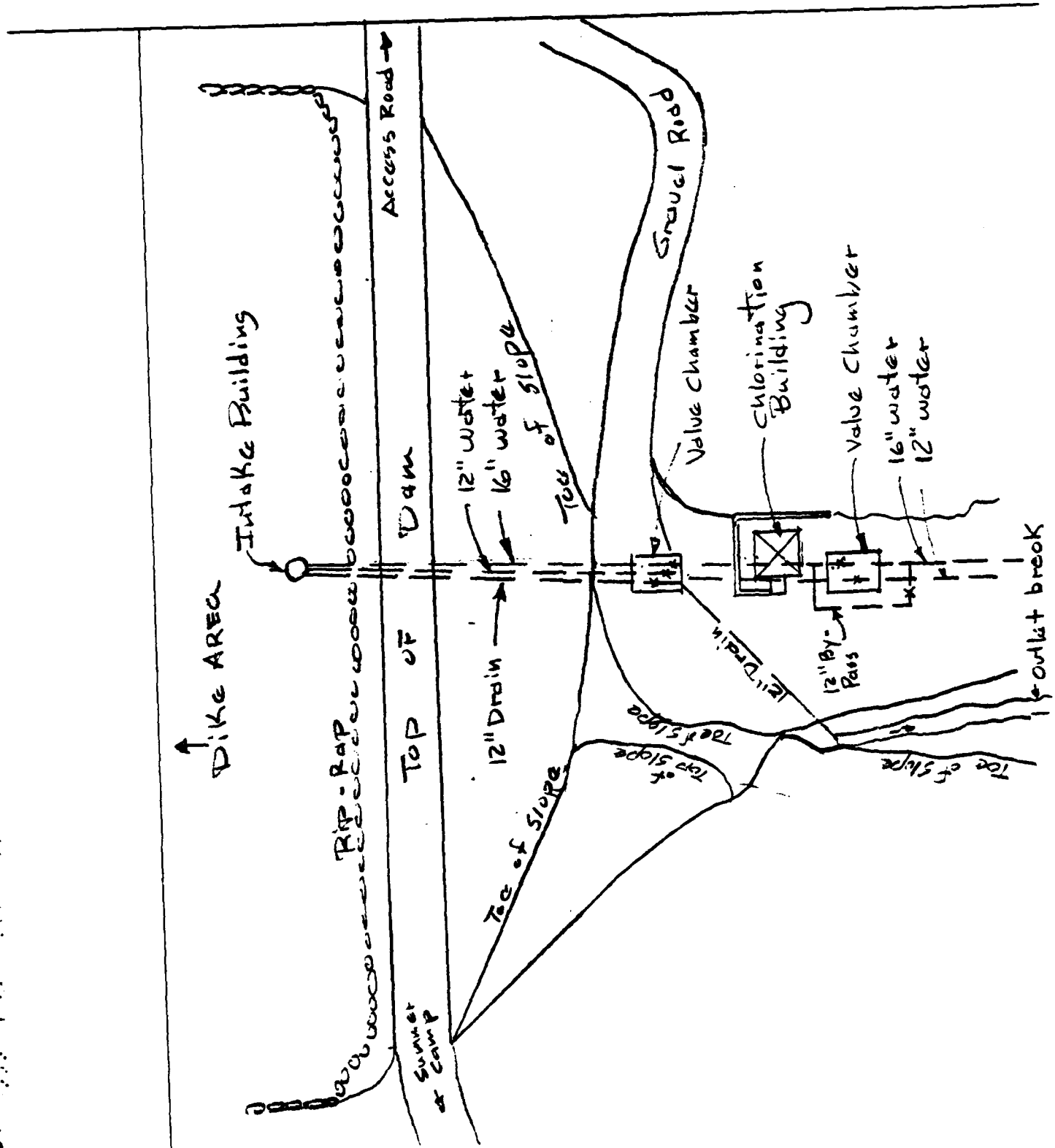


Spillway At Dike

JOB NO. 78,249.1
DATE 9-27-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

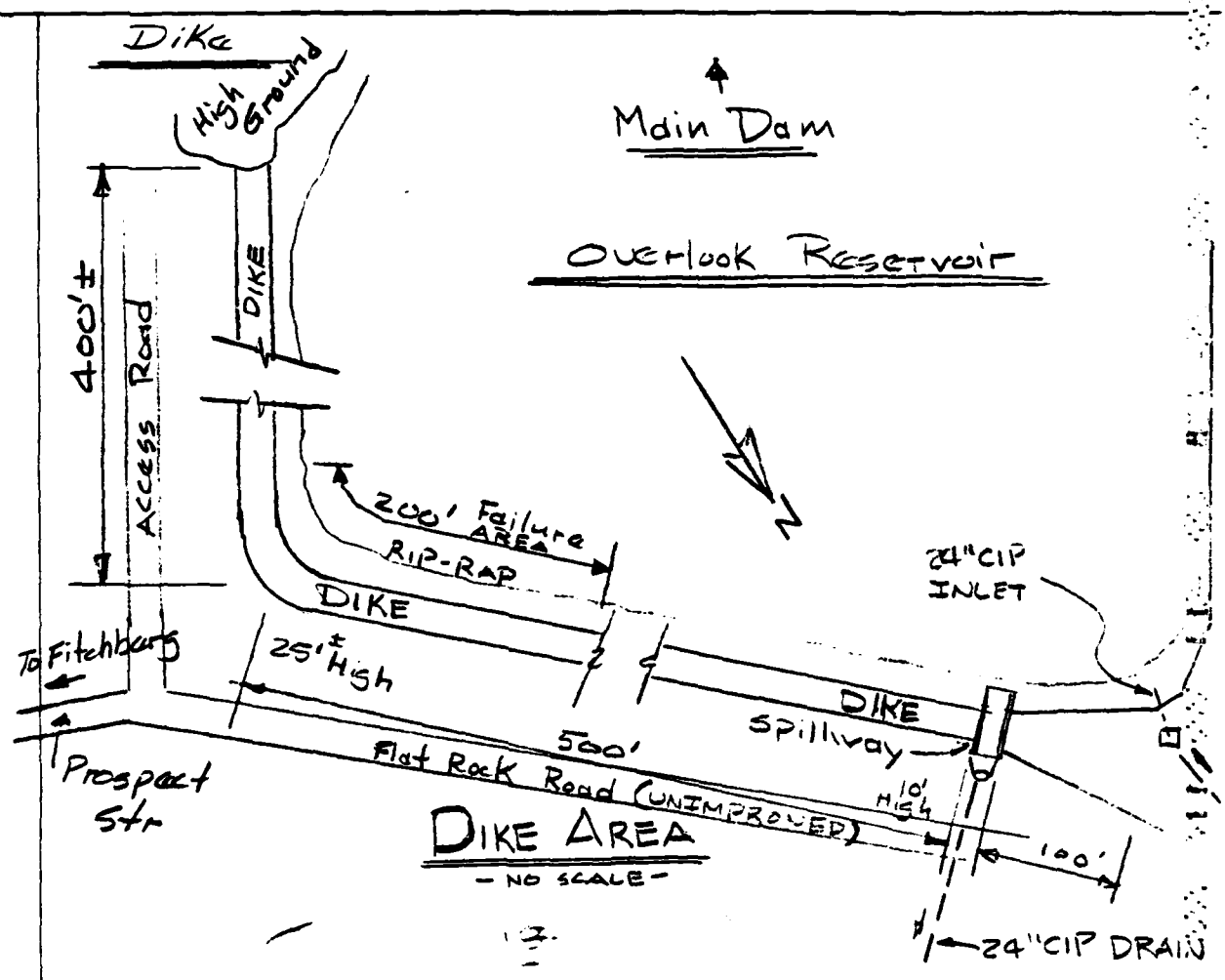
SHEET NO. 7
JOB Dams
SUBJECT Overlook
CLIENT Corps



JOB NO. 78,244.1
DATE 4/23/79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 5
JOB Dams
SUBJECT Overlook
CLIENT Corps

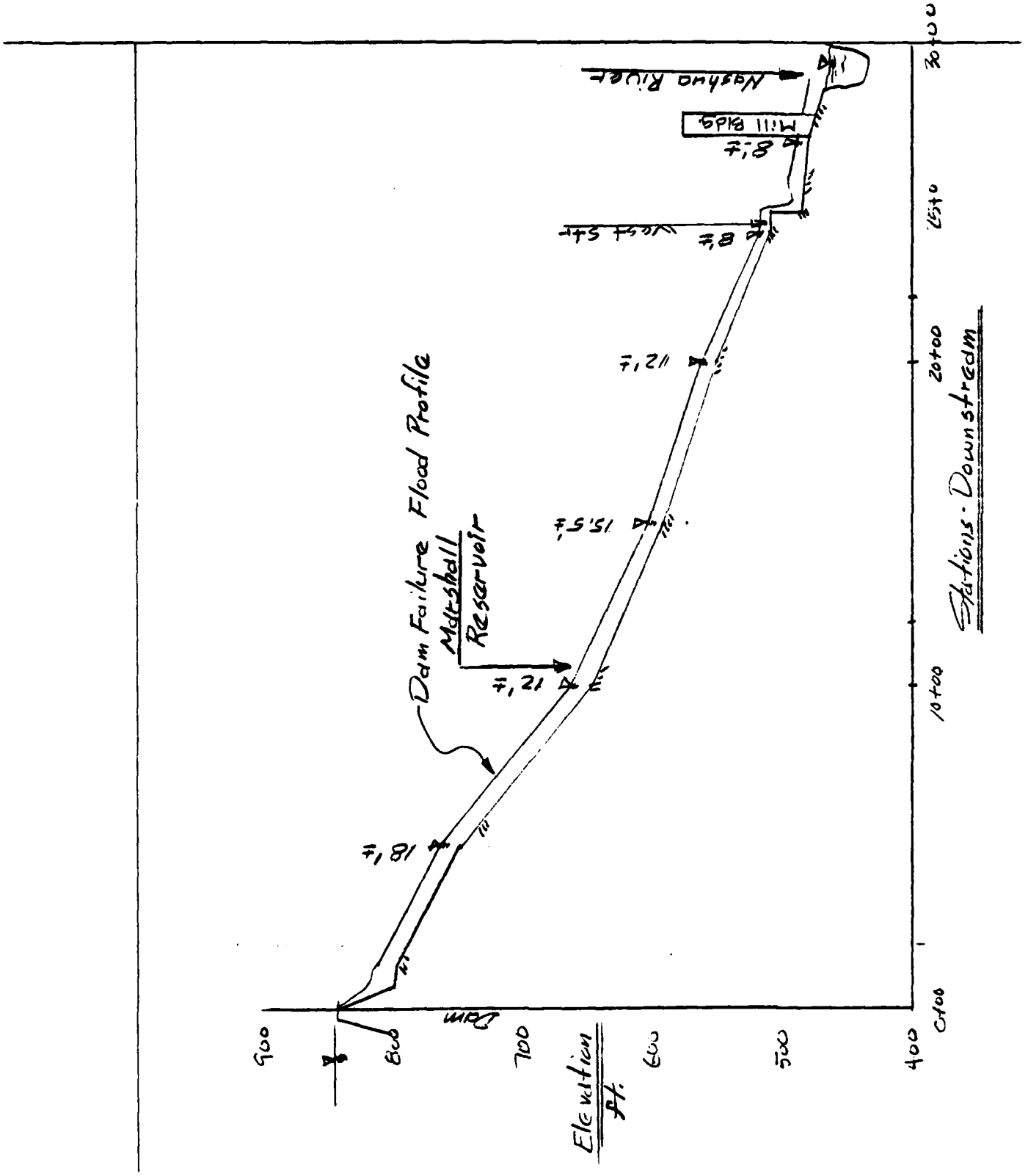


See Dike Failure Outflow on Page D-18!

JOB NO. 78.244.1
DATE 4-19-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 9
JOB Dams
SUBJECT Overlook
CLIENT Corps



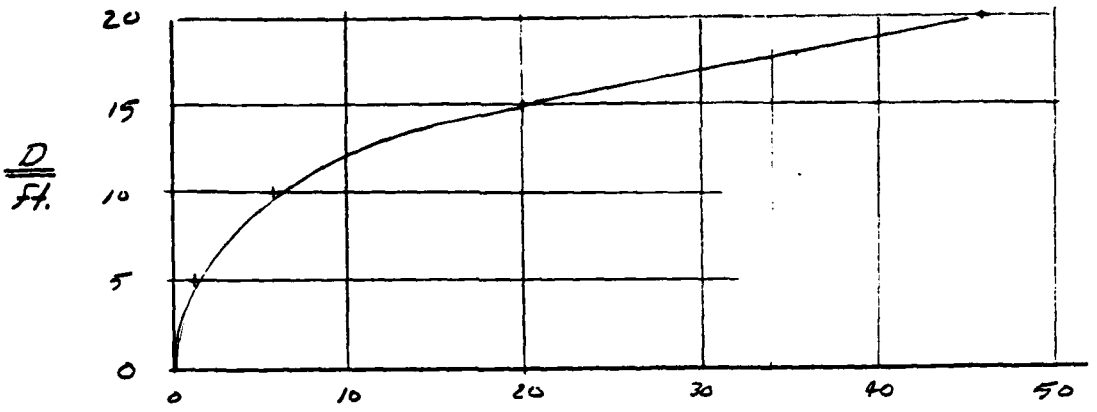
Sta 5+00

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = R^{2/3}(5.6)$

$n = 0.10$

$S = \frac{50}{350} = 0.14286'/'$

D	WP	A	$R^{2/3}$	F'	V	Q
5'	52	113	1.68	5.6	9.4	1,064.
10'	94	400	2.602	5.6	14.6	5828.
15'	170	1050	3.39	"	19.	19915.
20'	222	1925	4.25	"	23.8	45828.



$Q_{P_1} = 45{,}900$ cfs $D = \frac{Q \times 1000}{20'}$ $\bar{I} = \frac{4320 + 1925}{2}\left(\frac{500}{43560}\right) = 35.8$

$S = 270$ a-f $\quad \frac{1}{2}(S) = 135$ a-f

$Q_{P_2} = 45{,}900.\left(1 - \frac{35.8}{270}\right) = 39{,}814.$ cfs $\quad d = 18'$

$V_2 = \frac{4320 + 1575}{2}(.0115) = 33.9$ a-f ; $V_a = 34.9$ a-f

$Q_{P_3} = 45{,}900\left(1 - \frac{34.9}{270}\right) = 39{,}978.$ cfs

EI 778

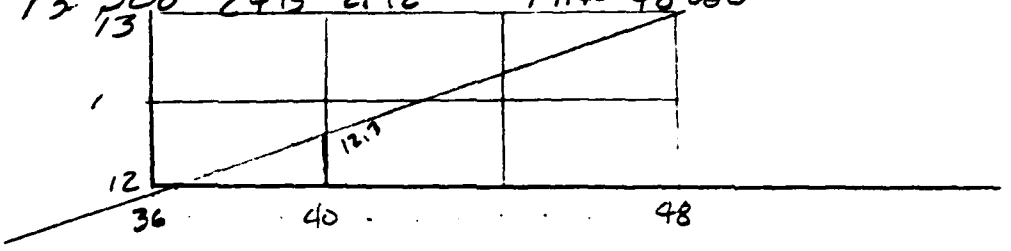
Sta 10+00

$n = 0.10$

$S = \frac{100}{500} = 0.2\%$

$V = \frac{1.486}{.11} R^{2/3} (.2)^{1/2} = R^{2/3} 6.65$

D	WP	A	$R^{2/3}$	F'	V	Q
10	267	925	2.3	6.65	15.3	14152
12	468	2045	2.69	"	17.85	36527
13	500	2475	2.92	"	19.4	48060



$Q_{P_1} = 39,978.$ cfs

$V_1 = \frac{1925 + 2174}{2} (.0115) = 23.57$ f-s

$Q_{P_2} = 39978. \left(1 - \frac{23.57}{270}\right) = 36,442.$ cfs 11.9

$V_2 = \frac{1926 + 2062}{2} (.0115) = 22.93,\ V_a = 23.25$

$Q_{P_3} = 39,978. \left(1 - \frac{23.25}{270}\right) = 36,535.$ cfs

El = 662±

JOB NO 78.294.1
DATE 9-5-78
BY mA
CH'D BY FDD

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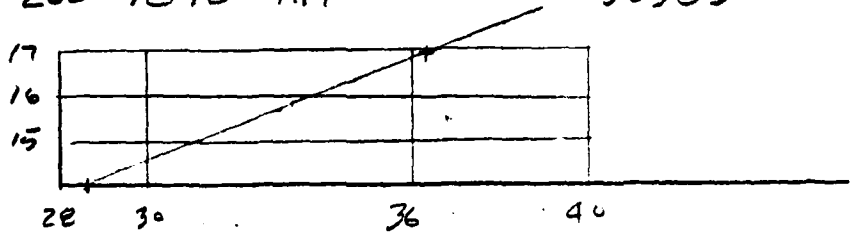
SHEET NO. 12
JOB Dams
SUBJECT Overlook
CLIENT Corps

Sta 15+00

$n = 0.10 \quad S = \frac{60}{500} = .22\ ft/ft \quad V = \frac{1.486}{.11}(R^{2/3})(.12)^{.5} = 5.15 \cdot R^{2/3}$

D	WP	A	$R^{2/3}$	F'	V	Q
10	131	650	2.92	5.15	15.06	9790
15	163	1350	4.12	"	21.23	28662
12.5	147	975	3.55	"	18.29	17838
17	200	1640	4.17		21.52	36365



$Q_{P_1} = 36535.$

$V_1 = \frac{2120 + 1650}{2}(.0115) = 21.67_{d-f}$

$Q_{P_2} = 36,535.\left(1 - \frac{2167}{270}\right) = 33,600\ cfs$

$V_2 = \frac{2120 + 650}{2}(.0115) = 20.99_{d-f} \quad V_a = 21.33$

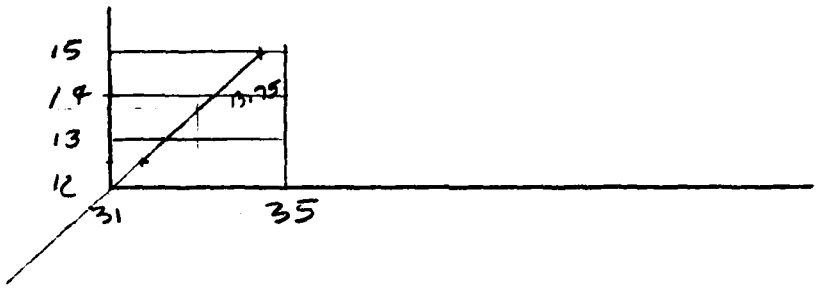
$Q_{P_3} = 36,535\left(1 - \frac{21.33}{270}\right) = 33,650.\ cfs$

El = 606 ±

Sta 20+00

$n = 0.10 \quad S = \frac{40}{500} = 0.08$ ft/ft $\quad V = \frac{1.486}{.1} R^{2/3} (.08)^{.5} = R^{2/3}\, 4.203$

D	WP	A	$R^{2/3}$	F'	V	Q
10	237	825	2.31	4.203	9.69	7,998
12.5	255	1938	3.89	"	16.35	31,700
15	283	2125	3.86	"	16.22	34,479



$Q_{P_1} = 33{,}650$ cfs

$V_1 = \frac{1590 + 2032}{2} (.0115) = 20.83$

$Q_{P_2} = 33650 \left(1 - \frac{20.83}{270}\right) = 31050$

$V_2 = \frac{1590 + 1750}{2} (.0115) = 19.$ $\quad V_a = 19.92$

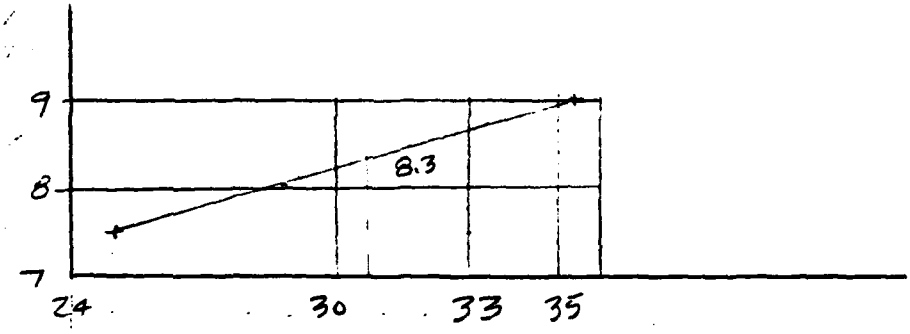
$Q_{P_3} = 33650. \left(1 - \frac{19.92}{270}\right) = 31170.$ cfs

El = 562.±

Sta 24+00

$n = 0.10 \quad S = \frac{40}{400} = .10$ ft/ft $\quad V = \frac{1.486}{.1} R^{2/3} (.1)^{\frac{1}{2}} = R^{2/3} 4.7$

D	WP	A	$R^{2/3}$	F'	V	Q
5	250	1000	2.53	4.7	11.9	11,900.
7.5	300	1675	3.17	"	14.9	24,919.
2.5	200	450	1.72	"	8.09	3,641.
9	330	2148	3.5	"	16.48	35410.



$Q_{P_1} = 31,170. \quad V_1 = \frac{1875+1927}{2} - (.009) = 17.46$ a-F

$Q_{P_2} = 31,170 \left(1 - \frac{16.55}{27a}\right) = 29,150.$

$V_2 = \frac{1875+1864}{2} - (.009) = 16.83$ a-f $\quad V_a = 17.15$

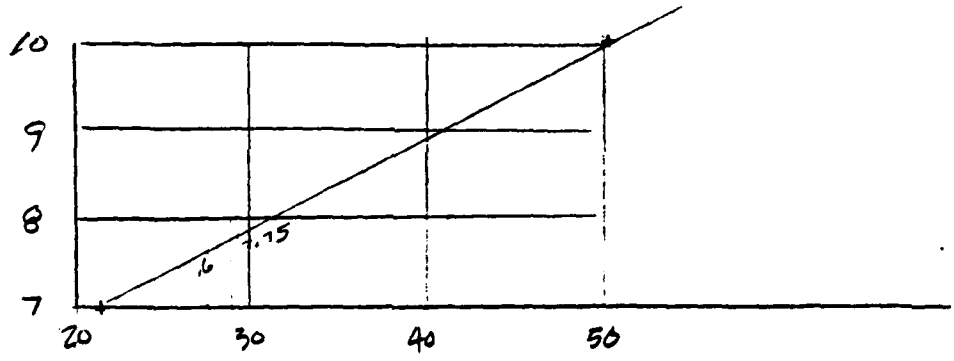
$Q_{P_3} = 31,170 \left(1 - \frac{17.15}{27a}\right) = 29190. \quad El = 518 \pm$

Sta 27+00

$n = 0.075 \quad S = \frac{32}{300} = 0.107\ ft/ft \quad V = \frac{1.486}{.075} R^{2/3} (.107)^{.5} = R^{2/3}\ 6.48$

D	WP	A	$R^{2/3}$	F'	V (f/s)	Q (cfs)
2	300'	200	0.76	6.48	5	1000
5	455	920	1.6	"	10.4	9555
10	595	2770	2.8	"	18.16	50,300
7'	545	1600	2.06	"	13.3	21,333

390



$Q_{P_1} = 29,190 \text{ cfs} \quad V_1 = \frac{1896+1893}{2}(.0069) = 13 \text{ a-f}$

$Q_{P_2} = 29190 \left(1 - \frac{13}{270}\right) = 27,780$

$V_2 = \frac{1896+1854}{2}(.0069) = 12.9 \quad V_a = 12.95$

$Q_{P_3} = 29,190 \left(1 - \frac{12.95}{270}\right) = 28475 \text{ cfs} \quad El = 4\pm 6$

JOB NO. 78.294.1
DATE 4-3-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
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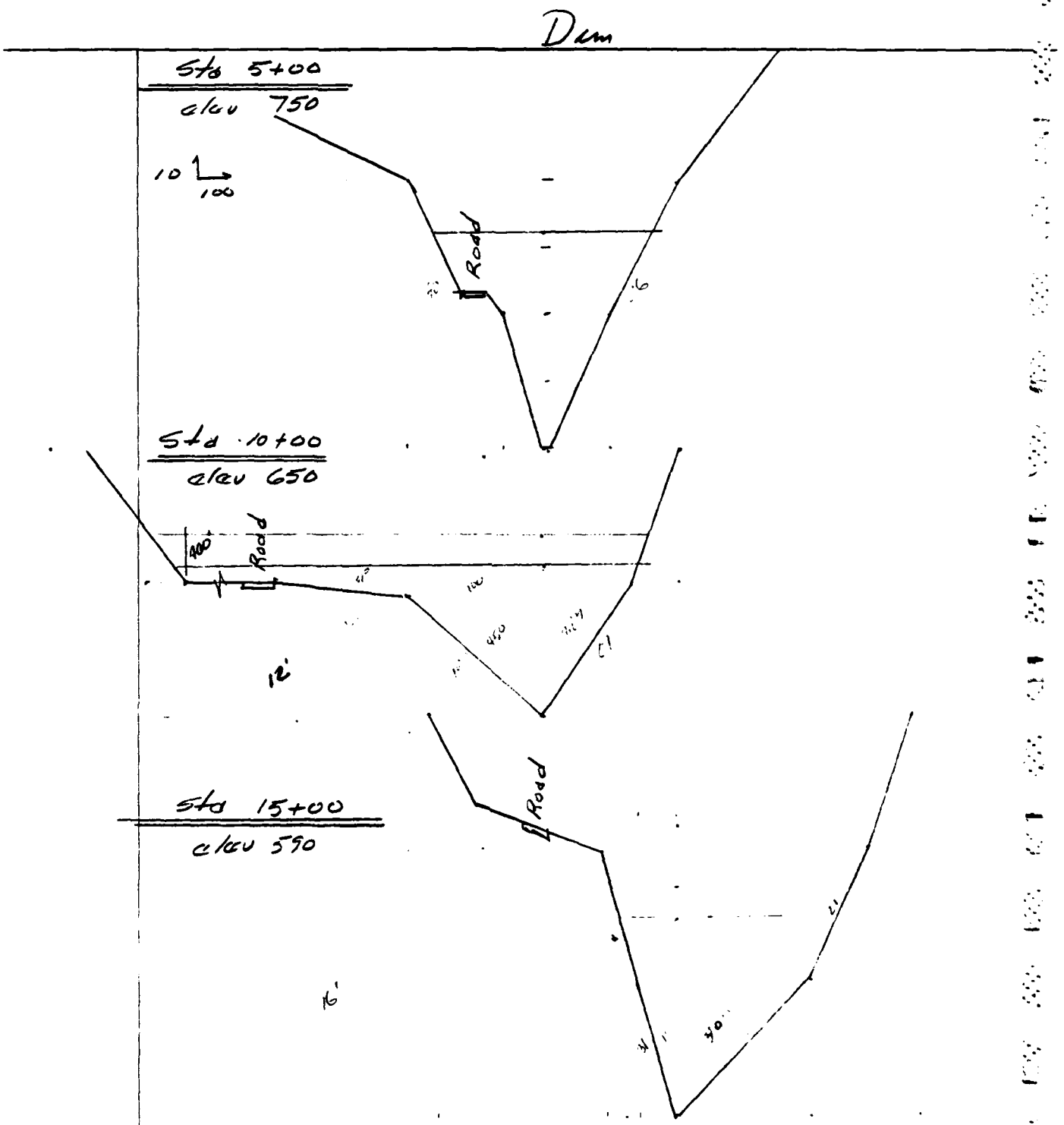
SHEET NO. 16
JOB Dams
SUBJECT Overlook
CLIENT Corps



JOB NO. 78,244.1
DATE 9-3-79
BY MA
CH'D BY FDD

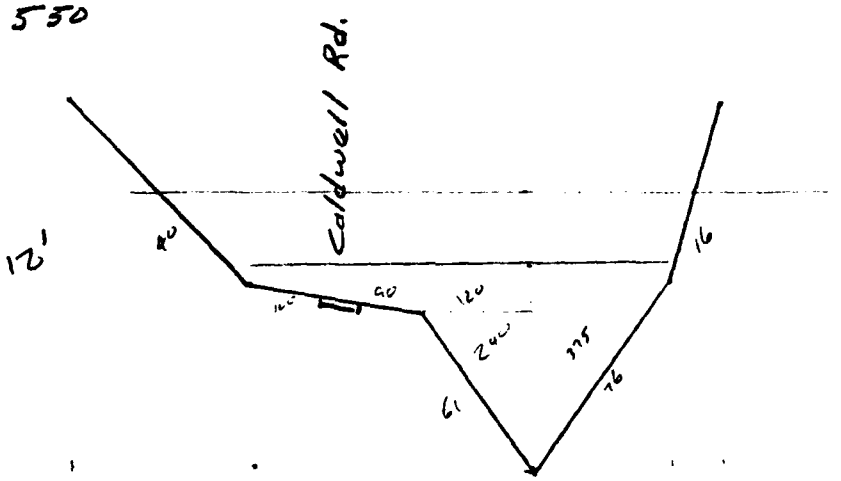
HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 17
JOB Dams
SUBJECT Overlook
CLIENT Corps

Dam

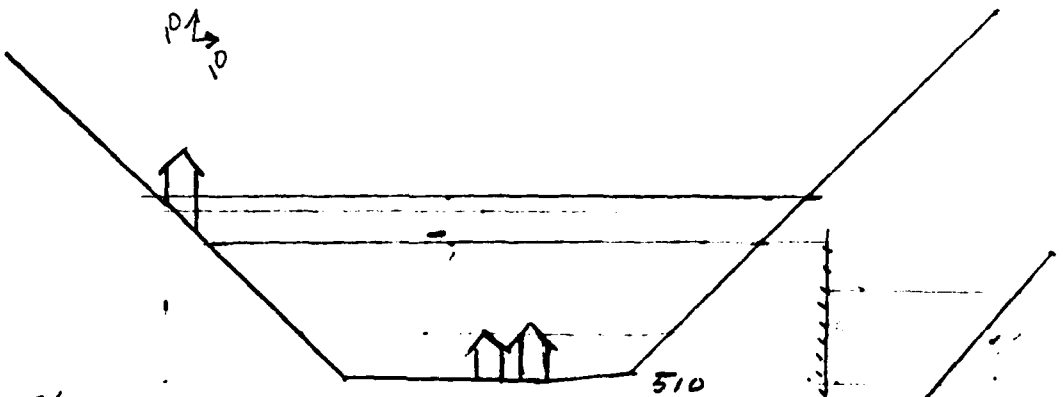
Sta 20+00

elev 550



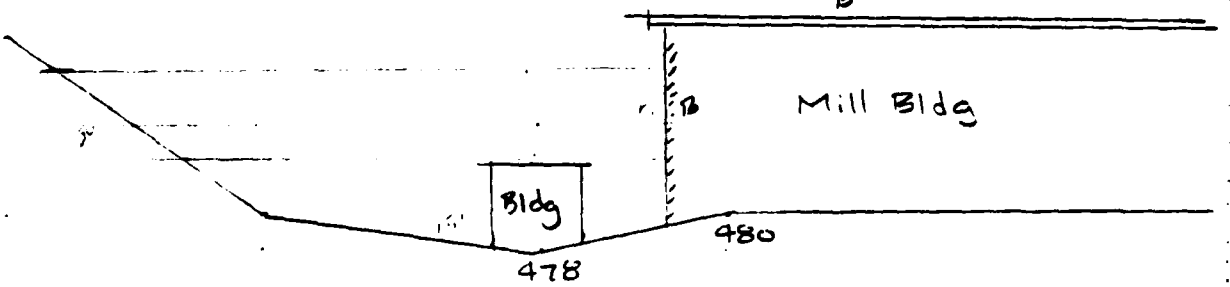
Sta 24+00

elev 510



Sta 27+00

elev 478



NO. 78.244.1
DATE 6-25-79
BY MA
CH'D BY FDD 7/12/79

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BOSTON, MASSACHUSETTS

SHEET NO. 18
JOB Dams
SUBJECT Overlook-Dik
CLIENT Corps

Dike Impact Area : High Hazard

Max Height = 25 ft. ±
Length of Max Height Section = 340' ft ±

Failure Outflow Highest dike section 25'±, length about 340'±, soils at base appear wet, d.s. slope 1 on 1± (steep), assume Test Flood Elev 835.5'± for water surface at failure, minor spillway discharge, assume breach width 340' for analysis. Does not appear to have core wall. Many trees on slope & base area.

$$Q_B = 8/27 \cdot (0.4 \times 340) \sqrt{32.2} \cdot (20)^{3/2} = 20{,}500^{\pm}_{cfs}$$

Failure assumed to occur near section of dike at junction of access road and Flat Rock Road / Prospect Str.

Sta	Flow	Flood Stage	Flood Elev	Damage
				water depth = ( )
0+00	20,500.	20'±	835.5	Breach in Dike
2+00	18,300.	5'.	815.	Prospect Str (15'), 2 Homes (2').
3+50	17,655.	6'.	806.	
5+00	16,860.	4'+.	784.	
7+50	15,768.	4'+.	754.	
12+00	14,132.	11'.	732.	
20+00	11,640.	8'	703	1 House (1'±).
25+	9,930.	14'.	704.	Hospital Rd (14')
30+	8,800.	14.	664	
35+	8,260.	16.	631.	
40+	7,400.	8.	618.	
45+	6890±	8.	571.	2 Homes (2'±).
47+	culvert at roadway			Mechanic St Urban Development of Fitchburg - Much damage expected.

JOB NO. 78244
DATE 6-26-79
BY MA
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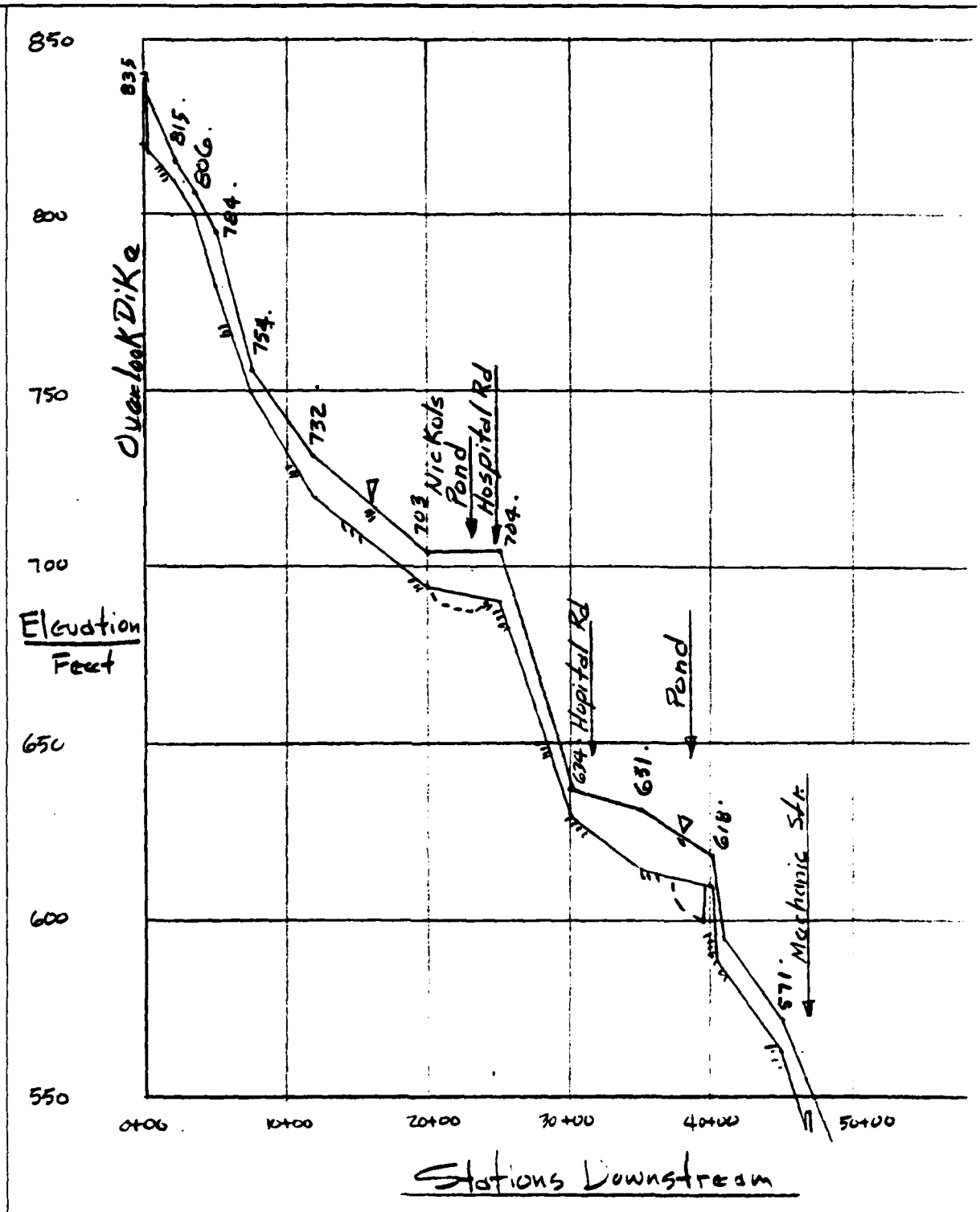
BOSTON, MASSACHUSETTS

SHEET NO. 19
JOB Dams
SUBJECT Overlook
CLIENT COE



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BOSTON, MASSACHUSETTS

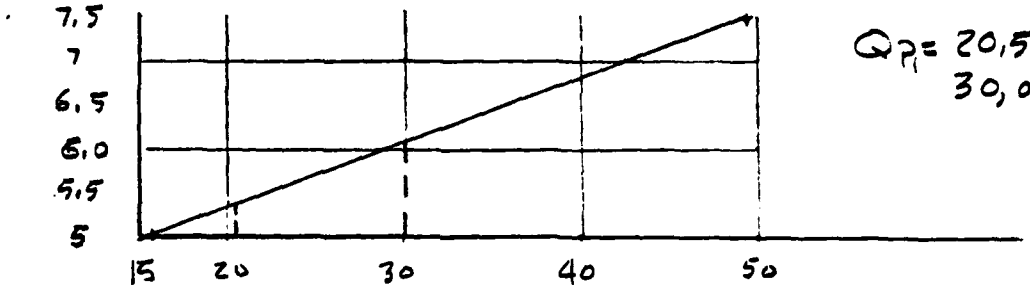
Std 2750

$n = 0.10$

$S^{1/2} = 0.224$

$V = \frac{1.486}{0.1} R^{2/3} (.224) = R^{2/3}\ 3.33$

D	WP	A	$R^{2/3}$	F'	V	Q
2.5						
5	550	2000	2.3	3.33	7.9	15,816.
7.5	650	4226	3.5	"	11.7	49,300.



$Q_{P_1} = 20{,}500$
$30{,}000$

$Q_{P_1} = 20{,}500$ cfs. $V_1 = \frac{2250+2710}{2}\left(\frac{250}{43560}\right) = 14$ f.

$S = 132$ $S/2 = 66$ a-f

$Q_{P_2} = 20500\left(1 - \frac{14}{132}\right) = 18{,}326$.

$El_2 = 5.25$ · $Stor_2 = \frac{2125+2710}{2}(\ ) = 14$

$Q_{P_3} = 18{,}300^{\pm}$ cfs

Elev 815.

10/8.9

JOB NO. 78244
DATE 6-25-79
BY MA
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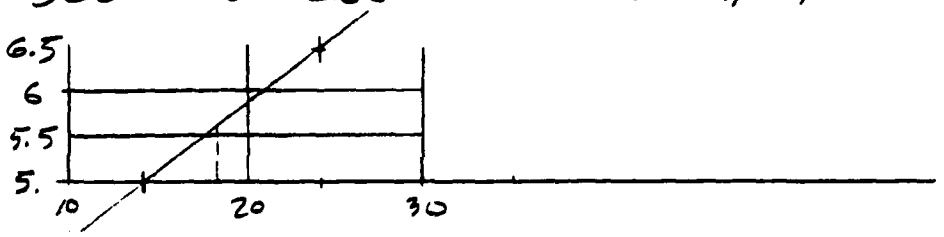
SHEET NO. 21
JOB Dam
SUBJECT Overlook
CLIENT COE

Sta 3+50

$S^{1/2} = (10/150)^{1/2} = .26$ $\quad V = \frac{1.486}{.11} R^{2/3} (.26) = R^{2/3}\, 3.86$

D	WP	A	$R^{2/3}$	E'	V	Q
5	475	1625	2.28 ·	3.86 ·	8.8 ·	14,300. ·
6.5	560	2375	2.63 ·	"	10.16 ·	24,119.



$Q_{P_1} = 18300 \cdot \quad V_1 = \frac{1925 + 2125}{2} \left(\frac{100.}{\ }\right) = 4.6 \cdot$

$Q_{P_2} = 18300 \left(1 - \frac{4.6}{132}\right) = 17{,}655.$

$El = 5.5 \cdot \quad V_2 = \frac{1875 + 2125}{2} (\ ) = 4.6 \cdot$

$Q_{P_3} = 17{,}655.$

Elev 806.

8.9 / 8.6

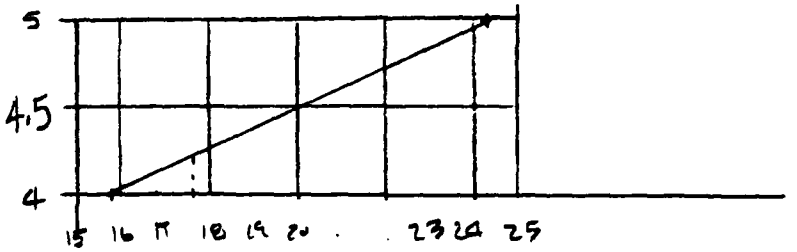
5+00

$n = 0.10$

$S^{1/2} = (20/150)^{1/2} = 0.365$

$V = \frac{1.486}{.1} R^{2/3} S^{1/2} = 5.43 \cdot R^{2/3}$

D	WP	A	$R^{2/3}$	F'	V	Q
4	520	1460	2	5.43	10.8	15800
5	600	2000	2.24	11	12.16	24300



$Q_{P_1} = 17{,}655$ cfs El = 784.25

$V_1 = \frac{1585 + 1875}{2} \left(\frac{150}{43560}\right) = 6.4$ f/s < 66 OK

$Q_{P_2} = 17655 \left(1 - \frac{6}{132}\right) = 16{,}858$ cfs

$El_2 = 784.13$ $V_2 = \frac{1525 + 1875}{2}(\ ) = 5.85$

$Q_{P_3} = 17655 \left(1 - \frac{5.93}{132}\right) = 16{,}863$

Qw. 784.

8.6/8.2

JOB NO. 79244
DATE 6-26-79
BY MA
CH'D BY FDD 7/12/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 23
JOB Dam
SUBJECT Overlook
CLIENT COE

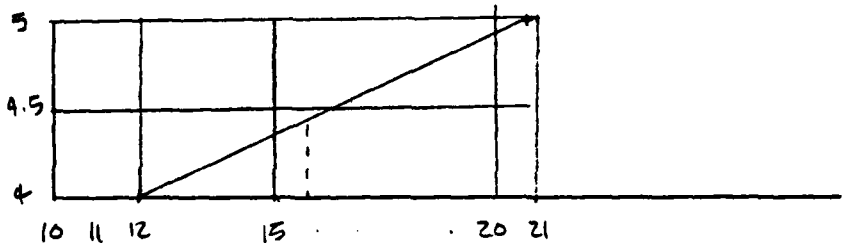
Sta 7+50

$n = 0.10$

$S^{1/2} = (30/250)^{1/2} = 0.346$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = R^{2/3}\ 5.14$

D	WP	A	$R^{2/3}$	F	V	Q
4	450	1200	1.9	5.14	9.9	11,900.
5	500	1750	2.3	"	11.9	20,822.



$QP_1 = 16,860$ cfs $El_1 = 754.5$

$V_1 = \frac{1463 + 1550}{2}\left(\frac{250}{43560}\right) = 8.6$

$QP_2 = 16,860\left(1 - \frac{8.6}{132}\right) = 15,756$

$El_2 = 754.4$ $V_2 = \frac{1420 + 1550}{2}(\ ) = 8.5$

$QP_3 = 16860\left(1 - \frac{8.55}{132}\right) = 15,768$

Elev 754±

8.2/7.7

JOB NO. 78244
DATE 6-26-79
BY MVF
CH'D BY FDD 7/12/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
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SHEET NO. 25
JOB Dawn
SUBJECT Overlk
CLIENT Cue

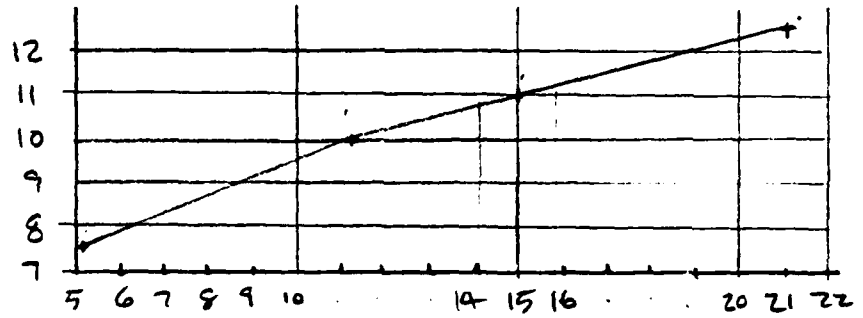
Sta 12+00

$n = 0.10$

$S^{1/2} = (30/450)^{1/2} = 0.2582$

$V = \frac{1.486}{.1}(S)^{1/2} R^{2/3} = R^{2/3}\ 3.84$

D	WP	A	$R^{2/3}$	F'	V	Q
5	105					
7.5	150	565	2.4	3.84	9.21	5203; ±
10	200	1000	2.94	"	11.3	11300. =
12.5	235	1550	3.54	"	13.6	21,065,
11	210	1205	3.22	"	12.4	15,000; ±



$Q_{P_1} = 15{,}768.$ cfs $El = 11.25'$.

$V_1 = \frac{1263 + 1440}{2}\left(\frac{450}{43560}\right) = 14.$

$Q_{P_2} = 15768.\left(1 - \frac{14}{132}\right) = 14100 \pm$ $El_2 = 10.75.$

$V_2 = \frac{1150 + 1440}{2}\left(\frac{450}{43560}\right) = 13.4.$

$Q_{P_3} = 15{,}768.\left(1 - \frac{13.7}{132.}\right) = 14{,}132.$ cfs

$El = 732.$

7.7 / 6.9

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BOSTON MASSACHUSETTS

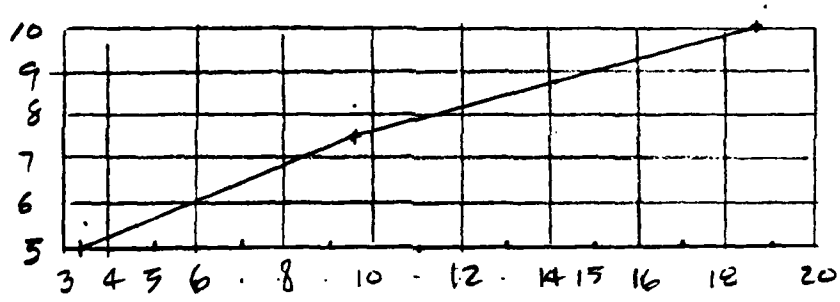
Std 20+00

$n = 0.10$

$S^{1/2} = (35/800)^{1/2} = 0.21$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = R^{2/3} 3.12$

D	W	A	$R^{2/3}$	F'	V	Q
5	200	550	1.97	3.12	6.14	3380
10	250	1675	3.58	"	11.15	18691
7.5	225	1075	2.85	"	8.9	9564



$QP_1 = 14130$. $El_1 = 8.75$.

$V_1 = \frac{1375 + 1210}{2} \left(\frac{800}{43560}\right) = 23.74$.

$QP_2 = 14132 \left(1 - \frac{23.74}{132}\right) = 11{,}590$.

$El_2 = 8$. $V_2 = \frac{1375 + 1210}{2} = 22.8$.

$QP_3 = 14{,}132 \left(1 - \frac{23.3}{132}\right) = 11{,}640$.

Elev = 703.

6.9/ 5.8

JOB NO. 78244
DATE 6-26-79
BY MK
CH'D BY FDD 7/12/79

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 21
JOB Davis
SUBJECT Quenk
CLIENT COE

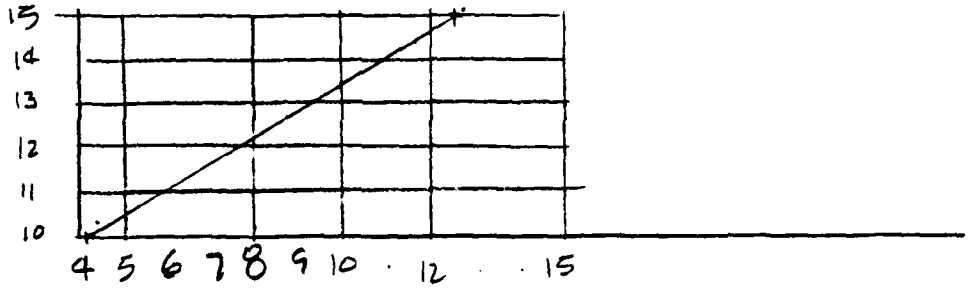
Std 25+00

$n = 0.1$

$S^{1/2} = (5/500)^{1/2} = 0.10.$

$V = \frac{1.486}{n} R^{2/3} S^{1/2} = R^{2/3} 1.486.$

D	WP	A	$R^{2/3}$	F'	V	Q
10	215	1000	2.8 ·	1.486 ·	4.16 ·	4,162. ·
15	350	2350	3.58 ·	" ·	5.32 ·	12308 ·



$Q_{P_1} = 11,640.$ $El_1 = 14.5$ · $V_1 = \frac{2175. + 1325.}{2}\left(\frac{500.}{43560.}\right) = 20.$ —

$Q_{P_2} = 11640.\left(1 - \frac{20.}{132.}\right) = 9876.$

$El_2 = 13.5.$ $V_2 = \frac{1945 + 1325.}{2}(.0115) = 18.8.$

$Q_{P_3} = 11,640.\left(1 - \frac{19.4.}{132}\right) = 9,929.$

$El_{eu} = 703.5.$ say 704.

5.8 / 5

Sta 30+00

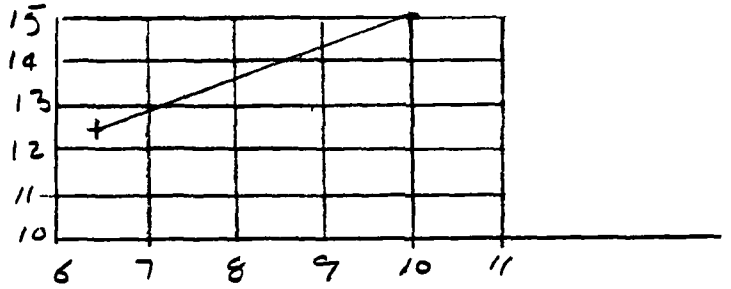
$Q_{P_1} = 9,930.$ cfs.

$n = 0.10$

$S^{1/2} = (60/500)^{1/2} = 0.3464.$

$V = \frac{1.486}{0.1} R^{2/3} S^{1/2} = 5.15.$

D	WP	A	$R^{2/3}$	F'	V	Q
10	55	250			5.15	
12.5	80	413	3.	5.15.	15.45.	6383.
15	110	613	3.16.	"	16.28.	9980.



$Q_{P_1} = 9930.$ $El_1 = 15' \pm.$

$V' = \frac{613. + 2060.}{2} \left(\frac{500}{43560}\right) = 15.34.$

$Q_{P_2} = 9930 \left(1 - \frac{15.34.}{132.}\right) = 8776.$ $El_2 = 14.$

$V_2 = \frac{533. + 2060.}{2} (\quad) = 14.88.$ $V_{ave} = 15.11$

$Q_{P_3} = 9930. \left(1 - \frac{15.11}{132}\right) = 8,793.$

$Elev = 14.0 + 650) \cong 664.$

5/4d

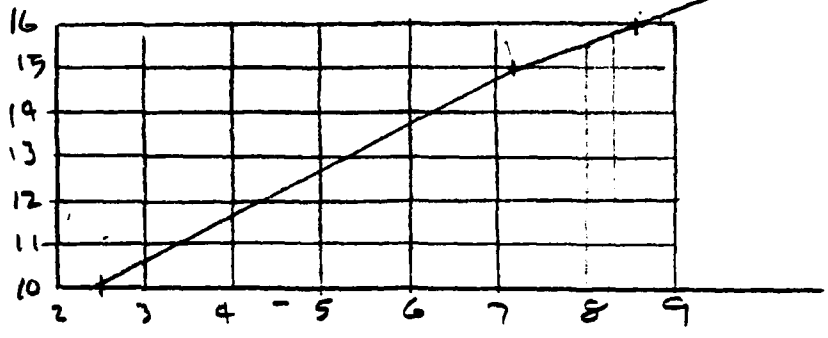
Sta 35+00

$n = 0.10$

$S^{1/2} = (15/500)^{1/2} = 0.1732$

$V = \frac{1.486}{0.1} R^{2/3} S^{1/2} = R^{2/3}\ 2.574$

D	WP	A	$R^{2/3}$	F'	V	Q
16	115	860	3.84		9.9	8522
15	105	750	3.73	2.57	9.61	7207
10	75	350	2.81	"	7.23	2529



$Q_{P_1} = 8800$ cfs $El_1 = 15.6$ $V_1 = \frac{820 + 573}{2}(0.0115)$

$V_1 = 8.0$

$Q_{P_2} = 8800\left(1 - \frac{8.0}{132}\right) = 8267$ $El_2 = 15.75$

$V_2 = \frac{830 + 573}{2}(0.0115) = 8.07$ $V_{ave} = 8.04$

$Q_{P_3} = 8800\left(1 - \frac{8.04}{132}\right) = 8264$

4.4 / 4.12 $El_{CV_1} = 631\pm$

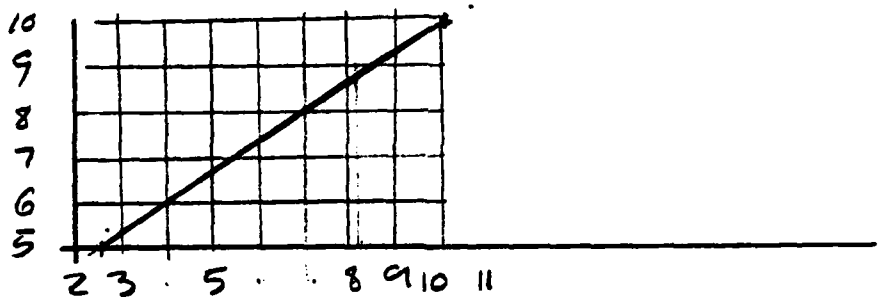
Sta 40+00

$n = 0.10$

$S^{1/2} = (5/500)^{1/2} = 0.1$

$V = \frac{1.486}{0.1} R^{2/3} S^{1/2} = R^{2/3} 1.486$

D	WP	A	$R^{2/3}$	F'	V	Q
5	285	750	2.38	1.486	3.54	2658
10	325	2000	3.38	"	5.02	10,040



$Q_{P_1} = 8260$ $El_1 = 8.75$ $V_1 = \frac{1698 + 825}{2}(0.0115) = 14.4$

$Q_{P_2} = 8260\left(1 - \frac{14.4}{132}\right) = 7359$ $El_2 = 8$

$V_2 = \frac{500 + 825}{2}(.0115) = 13.4$ $V_{ave} = 13.9$

$Q_{P_3} = 8260\left(1 - \frac{13.9}{132}\right) = 7390$. cfs

Elev = 618.

4.2/3.7

79.134.18
10-5-79
MA
BY FDD

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CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

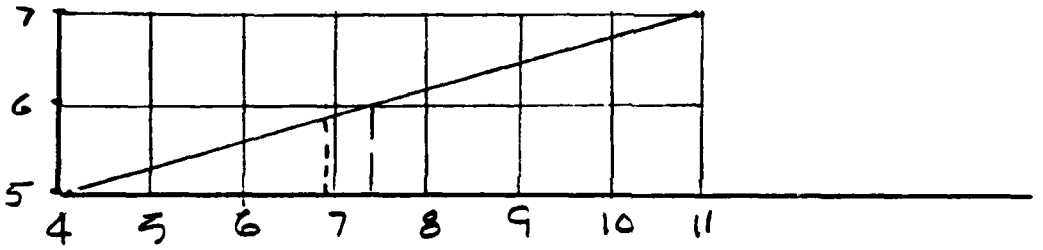
SHEET NO. 30
JOB Dams
SUBJECT Overlook - Dike
CLIENT Fitchburg

Sta 45+00 $\quad Q_{P_1} = 7{,}390.$ cfs

$n = 0.10 \qquad S = \frac{610-565}{500} = 0.09$ F/F

$V = \frac{1.486}{0.1} R^{.67} (0.09)^{1/2} = 4.458\ R^{2/3}$

D	WP	A	$R^{2/3}$	4.46	V	Q
5	225	525	1.76	"	7.9	4130. cfs
7	260	995	2.46	"	11.	10,906.



$Q_{P_1} = 7{,}390.$ cfs $\quad El_1 = 6' \quad V_1 = \frac{760+825}{2}(.0115) = 9.1$ aF

$Q_{P_2} = 7390\left(1 - \frac{9.1}{132}\right) = 6{,}880.$ cfs

$El_2 = 5.8' \quad V_2 = \frac{713+825}{2} = 8.85 \quad V_{ave} = 9\pm$ aF

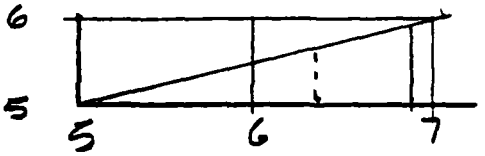
$Q_{P_3} = 7390\left(1 - \frac{9}{132}\right) = 6{,}888.$ cfs

$D_3 = 5.8 \quad Elev_3 = 565 + 5.8 \simeq 571\pm$

Std 50+00 $S = \frac{25}{500} = 0.05'$ $Q_{P_1} = 6888.$

$n = 0.10$ $EI = 540$ $V = \frac{1.486}{.1}(R^{2/3})(.05)^{1/2} = R^{2/3}\,3.32$

D	WP	A	$R^{2/3}$	3.32	V	Q
5	215	690	2.18	"	7.25	5003.
6	410	1100	1.94	"	6.43	7,075.



$Q_{P_1} = 6,888.$ $D_1 = 5.9$ $V_1 = \frac{1060 + 730}{2}(.0115) = 10.3$ a-f

$Q_{P_2} = 6,888.\left(1 - \frac{10.3}{132}\right) = 6,350.$ cfs

$D_2 = 5.75$ $V_2 = \frac{980 + 730}{2}(.0115) = 9.8$

$V_a = 10.1$ a-f

$Q_{P_3} = 6,888.\left(1 - \frac{10.1}{132}\right) = 6,363.$ cfs

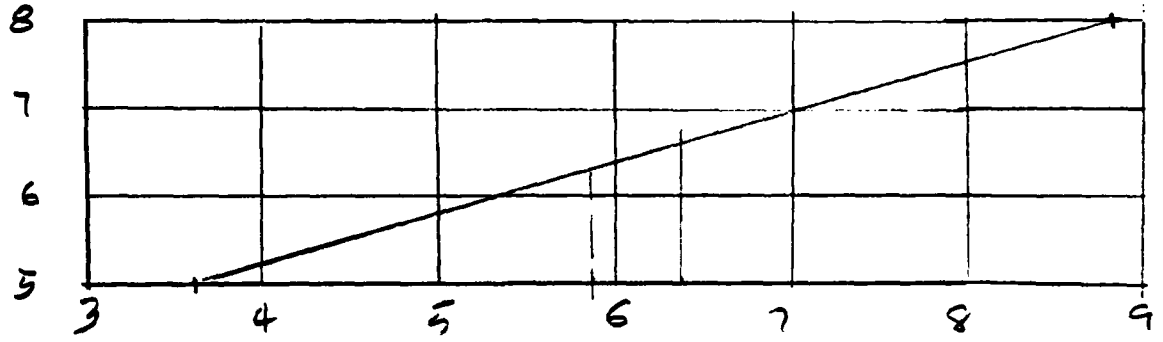
$D_3 = 5.75$ $EI = 545.75$

Std 55+00 $Q_{P_1} = 6,363.$ cfs

$n = 0.15$ $S = \frac{38}{500} = 0.076'/'$

$V_1 = \frac{1.486}{0.15} R^{2/3} (.076)^{1/2} = R^{2/3}\ 2.73$

D	WP	A	$R^{2/3}$	2.73	V	Q
8	210	1080	3	"	8.18	8,833.
5	160	570	2.34	"	6.4	3,645.



$Q_{P_1} = 6363$ $D_1 = 6.6$ $V_1 = \frac{845 + 1020}{2}(.0115) = 10.7$ c.f.

$Q_{P_2} = 6363\left(1 - \frac{10.7}{132}\right) = 5,846.$

$D_2 = 6.3'$ $V_2 = \frac{791 + 1020}{2}(.0115) = 10.4$

$V_{ave} = 10.6$

$Q_{P_3} = 6363\left(1 - \frac{10.6}{132}\right) = 5,854.$ cfs

$D_3 = 6.3$ Elev = 508.3'

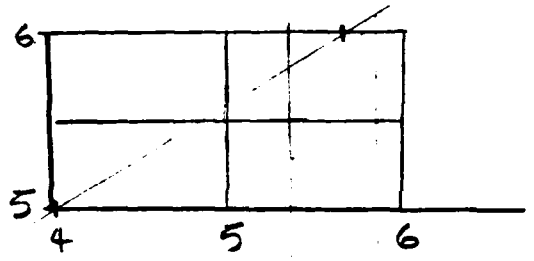
Std 60+00

$Q_{P_1} = 5854$

$n = 0.15 \qquad S = \frac{22}{500} = 0.044$ ft/ft

$V = \frac{1.486}{.15} R^{2/3} (.044)^{1/2} = 2.08\, R^{2/3}$

D	WP	A	$R^{2/3}$	2.08	V	Q
5	180	745	2.59	"	5.39	4,013.
6	190	935	2.90	"	6.03	5,640



$Q_{P_1} = 5854 \qquad D_1 = 6.1' \qquad V_1 = \frac{1035 + 825}{2}(.0115) = 10.7$

$Q_{P_2} = 5854\left(1 - \frac{10.7}{132}\right) = 5379.$

$D_2 = 5.8' \qquad V_2 = \frac{888 + 825}{2}(\ ) = 9.85$

$V_{ave} = 10.3$ d.f

$Q_{P_3} = 5854\left(1 - \frac{10.3}{132}\right) = 5397.$

$D_3 = 5.8'$: Elev = 485.8

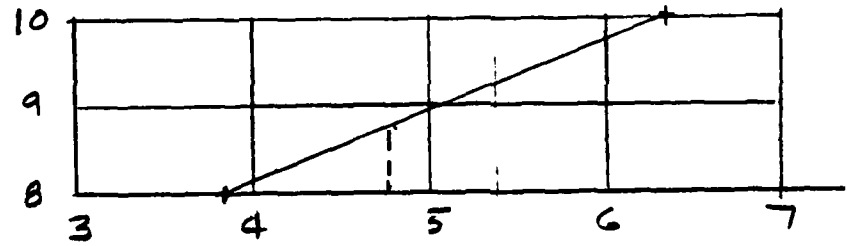
Std 65+00

Q_{P_1} = 5397 cfs

$n = 0.15 \quad S = \frac{6}{500} = 0.012$ ''/'

$V = \frac{1.486}{.115}(R^{2/3})(0.012)^{1/2} = R^{2/3}\ 1.08$

D	WP	A	$R^{2/3}$	1.08	V	Q
6	220	780	2.33	"	2.52	1,967.
8	265	1260	2.84	"	3.07	3,868.
10	335	1860	3.15	"	3.41	6,335.



Q_{P_1} = 5,397. D_1 = 9.25 $V_1 = \frac{1635 + 960}{2}(.0115) = 15$ cf

$Q_{P_2} = 5397\left(1 - \frac{15}{132}\right) = 4787.$ cfs

D_2 = 8.75 $V_2 = \frac{1485 + 960}{2}(.0115) = 14$ cf

V_a = 14.5 cf

$Q_{P_3} = 5397\left(1 - \frac{14.5}{132}\right) = 4804$

D_3 = 8.8 Elev = 483 ±

JOB NO. 79.134.18
DATE 10-5-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 35
JOB Dams
SUBJECT Overlook-Dike
CLIENT Fitchburg

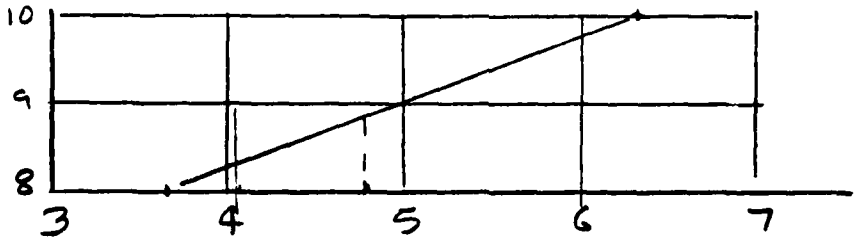
Std 70+00

Q_{P_1} = 4,800.± cfs

$n = 0.15 \quad S = \frac{4}{500} = 0.008$

$V = \frac{1.486}{0.15} R^{2/3} (.008)^{1/2} = R^{2/3}\ 0.886$

D	WP	A	$R^{2/3}$	0.886	V	Q
5	250	625	1.85	"	1.64	1,023.
7	340	1225	2.36	"	2.1	2,562.
10	500	2455	2.90	"	2.573	6,317.
8	380	1585	2.6	"	2.31	3656.



Q_{P_2} = 4,800. cfs $D = 8.8 \quad V_1 = \frac{1933 + 1560}{2}(.0115) = 20.1$ af

$Q_{P_2} = 4800\left(1 - \frac{20.1}{132}\right) = 4070$

$D_2 = 8.3 \quad V_2 = \frac{1716 + 1560}{2}(.0115) = 18.84$

$Va = 19.5$ a-f

$Q_{P_3} = 4800\left(1 - \frac{19.5}{132}\right) = 4,100.$

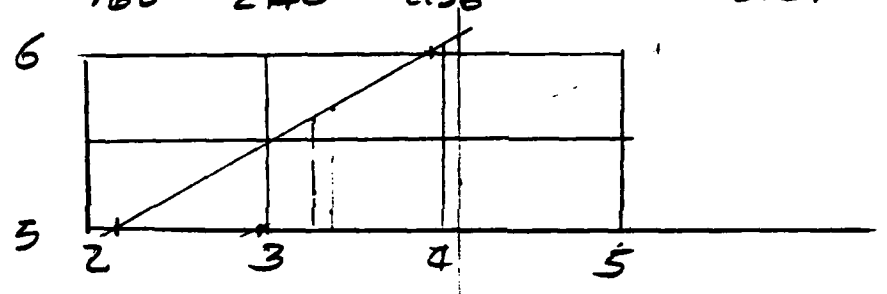
$D_3 = 8.3 \quad Elev = 478.3$

Std 75+00

$n = 0.25 \quad S = \frac{13}{500} = 0.026''/'$

$V = \frac{1.486}{0.25}(R^{2/3})(.026)^{1/2} = 0.96 \cdot$

D	WP	A	$R^{2/3}$	0.96	V	Q
5	600	1320	1.70	"	1.63	2149
6	660	1980	2.09	"	2	3960
7	760	2740	2.36	"	2.27	6211



$Q_{P_1} = 4100 \cdot \quad D_1 = 6.1 \cdot \quad V_1 = \frac{2820+1825}{2}(.0115) = 26.8 \cdot$

$Q_{P_2} = 4100\left(1 - \frac{26.8}{132}\right) = 3270 \cdot$

$D_2 = 5.6 \quad V_2 = \frac{1716+1825}{2}(.0115) = 20.4$

$V_{ave} = 23.6 \cdot \text{a-f}$

$Q_{P_3} = 4100\left(1 - \frac{23.6}{132}\right) = 3368 \cdot$

$D = 5.7' \quad \text{Elev} = 463\pm$

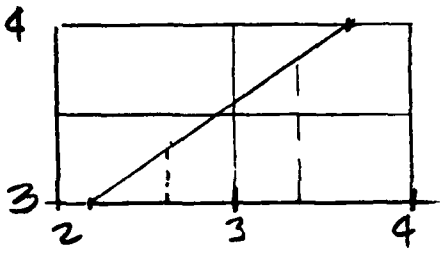
Sta 80+00

$QP_1 = 3368$

$n = 0.25 \quad S = \frac{4}{500} = 0.008$ ft/ft

$V = \frac{1.486}{.25} R^{2/3} (.008)^{1/2} = 0.53 R^{2/3}$

D	WP	A	$R^{2/3}$	$0.53 \cdot$	V	Q
3'	800	2130	1.93	"	1.02	2175
4'	900	3030	2.26	"	1.20	3622



$QD_1 = 3368 \quad D_1 = 3.75'$

$V_1 = \frac{2805 + 2270}{2} (.0115) = 29.18$ c.f.

$QP_2 = 3368 \left(1 - \frac{29.18}{132}\right) = 2623$

$D_2 = 3.3 \quad V_2 = \frac{2400 + 2270}{2} (.0115) = 26.85$

$V_{ave} = 28 \pm$ c.f.

$QP_3 = 3368 \left(1 - \frac{28}{132}\right) = 2653$

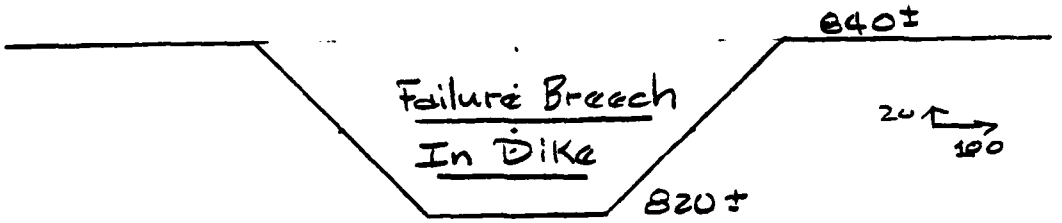
$D = 3.3 \quad Elev = 457 \pm$

JOB JOB NO. 78244
DATE 6-25-79
BY MVG
CH'D BY FDD

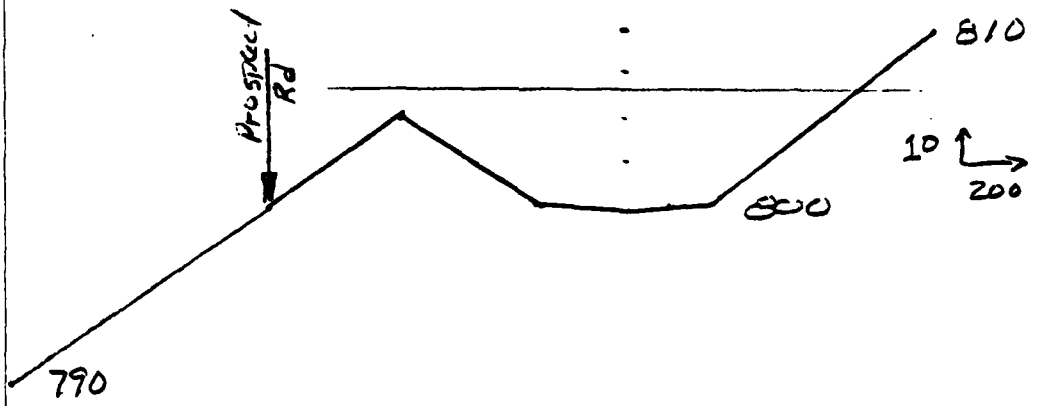
HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 38
JOB Dewey
SUBJECT Dewey Overtopping
CLIENT

Sta 0+00



Sta 3+50



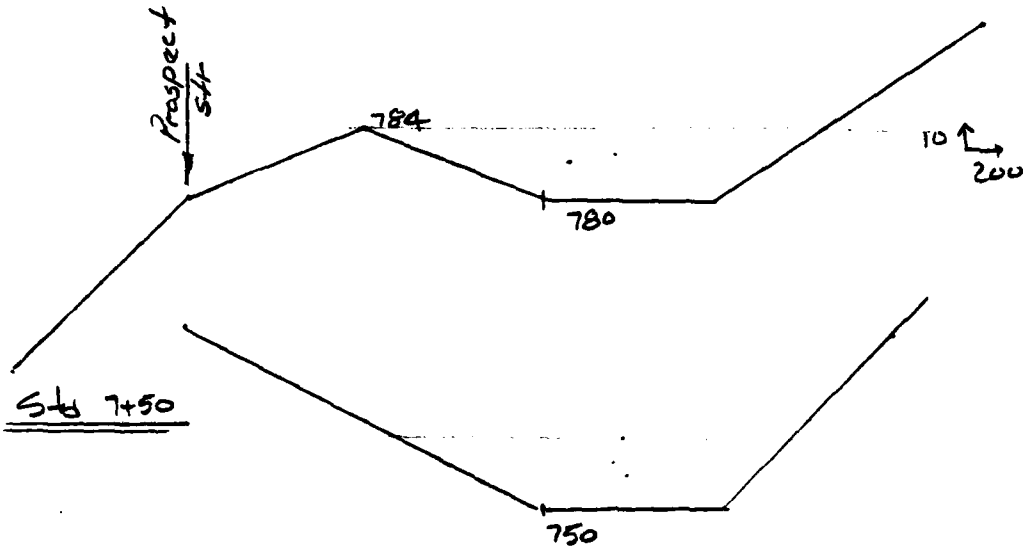
Sta 2+50

JOB NO. 78244
DATE 6-26-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

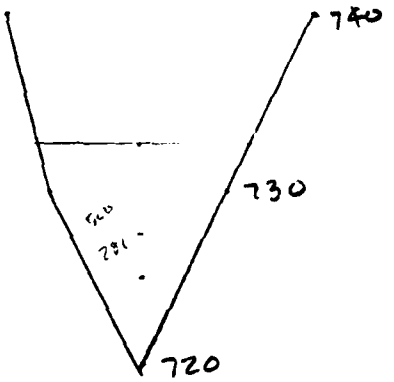
SHEET NO. 51
JOB Dams
SUBJECT Ouink
CLIENT COE

Std 5+00

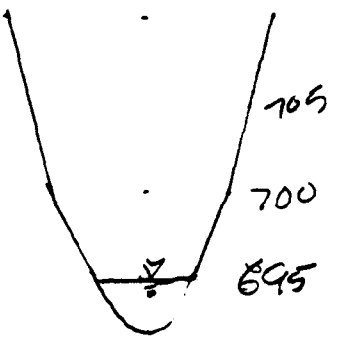


Std 7+50

Std 12+00 elev 720



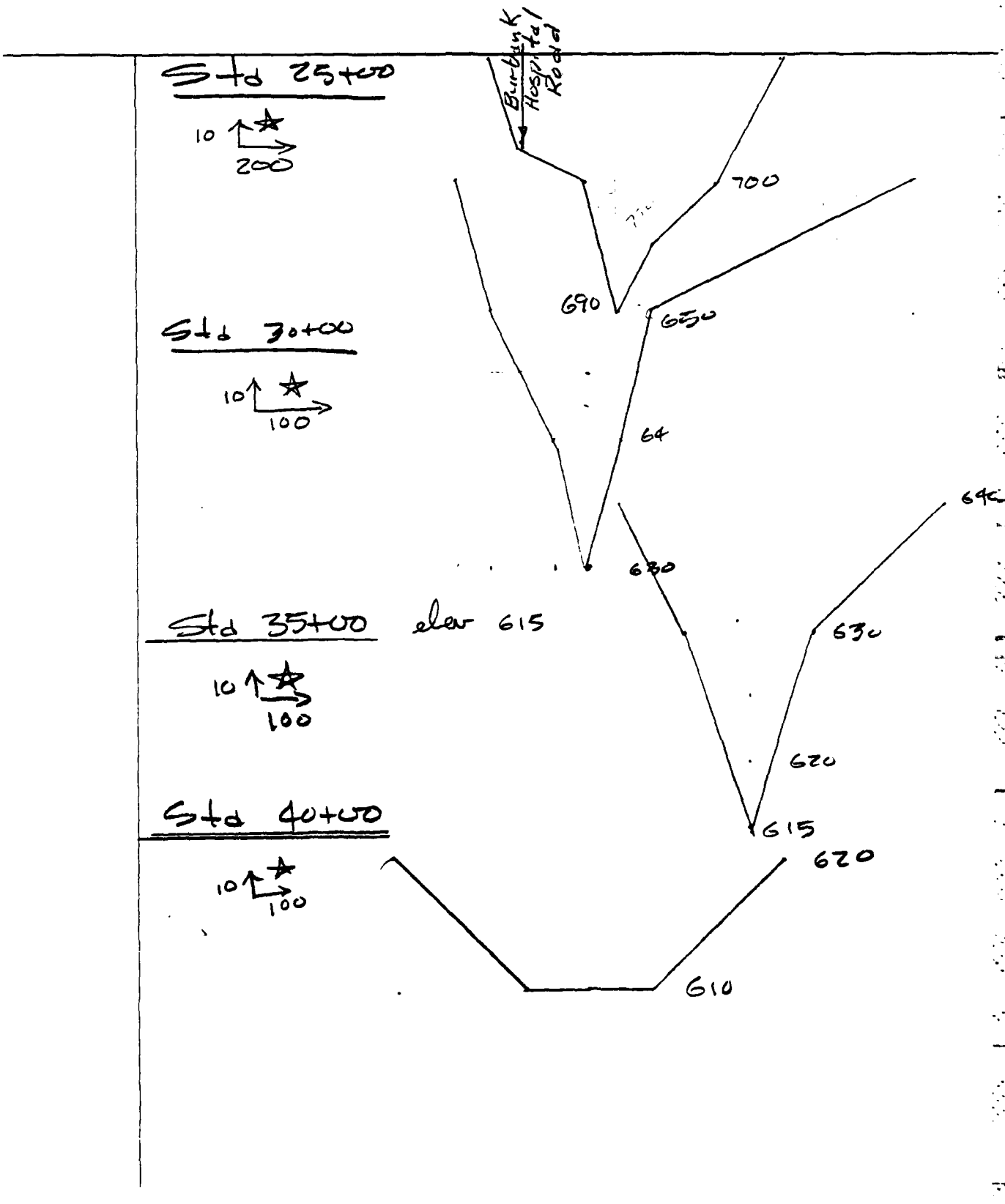
Std 20+00



JOB NO. 78244
DATE 6-26-79
BY MA
CH'D BY EDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

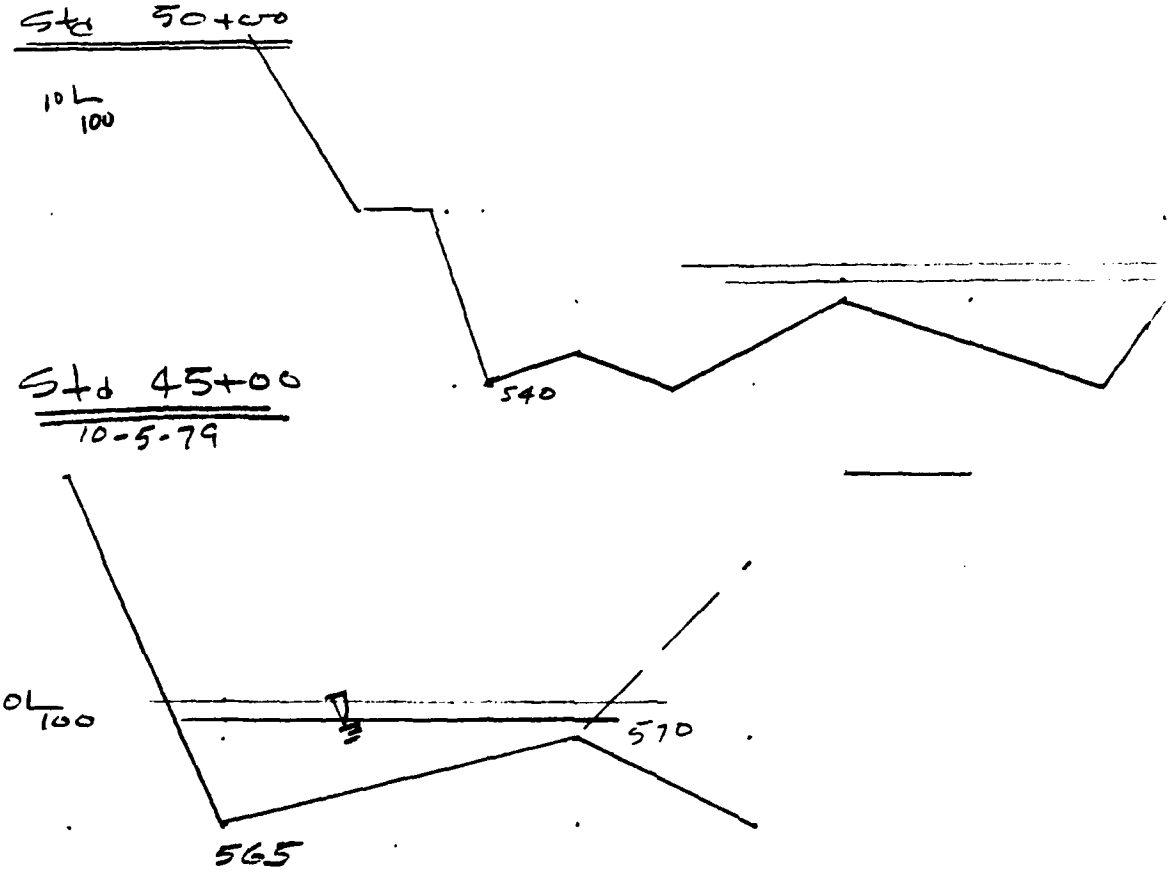
SHEET NO. 40
JOB Dams
SUBJECT Quinn
CLIENT COE



JOB NO. 7824d
DATE 6-26-79
BY MA
CH'D BY FDD

HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 41
JOB Dam
SUBJECT Overlay
CLIENT COE

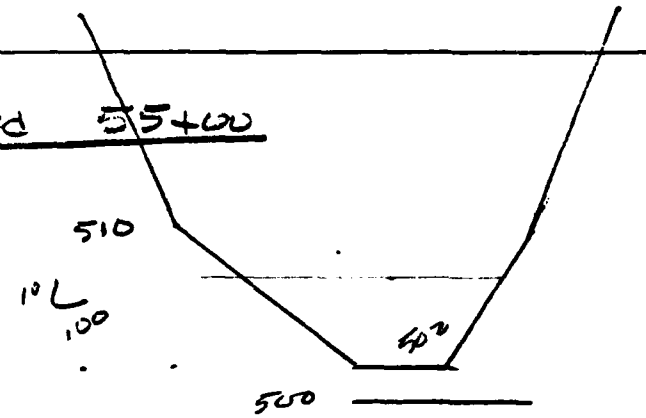


JOB NO. 79,134.18
DATE 10-5-79
BY MB
CH'D BY FDD

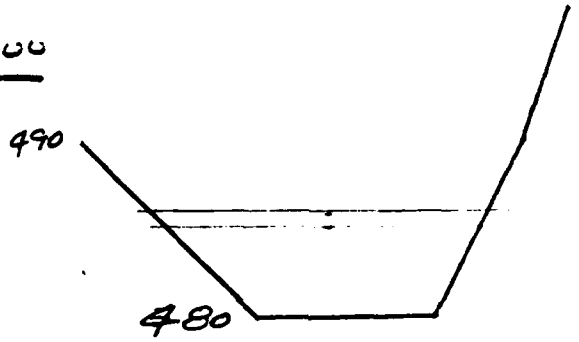
HH&B HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON MASSACHUSETTS

SHEET NO. 42
JOB Dam
SUBJECT Quick
CLIENT COE

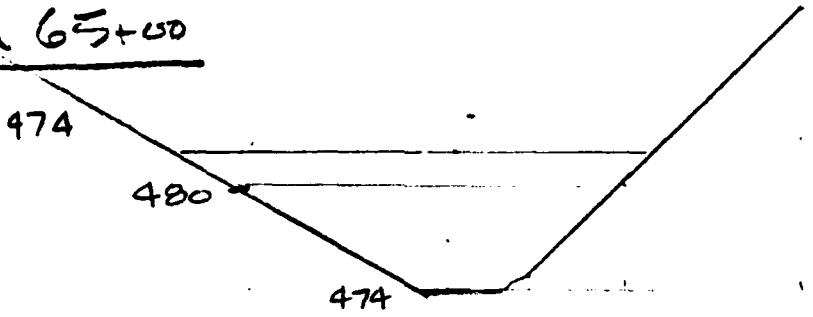
Sta 55+00



Sta 60+00



Sta 65+00



Sta 70+00

JOB NO. 79.134.18
DATE 10-5-79
BY MA
CH'D BY FDD

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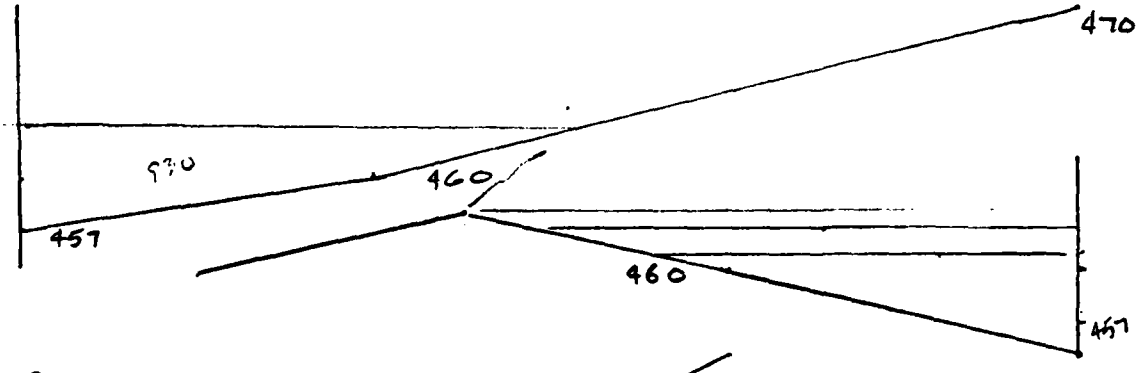
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

SHEET NO. 43
JOB Dams
SUBJECT Quantity
CLIENT COE

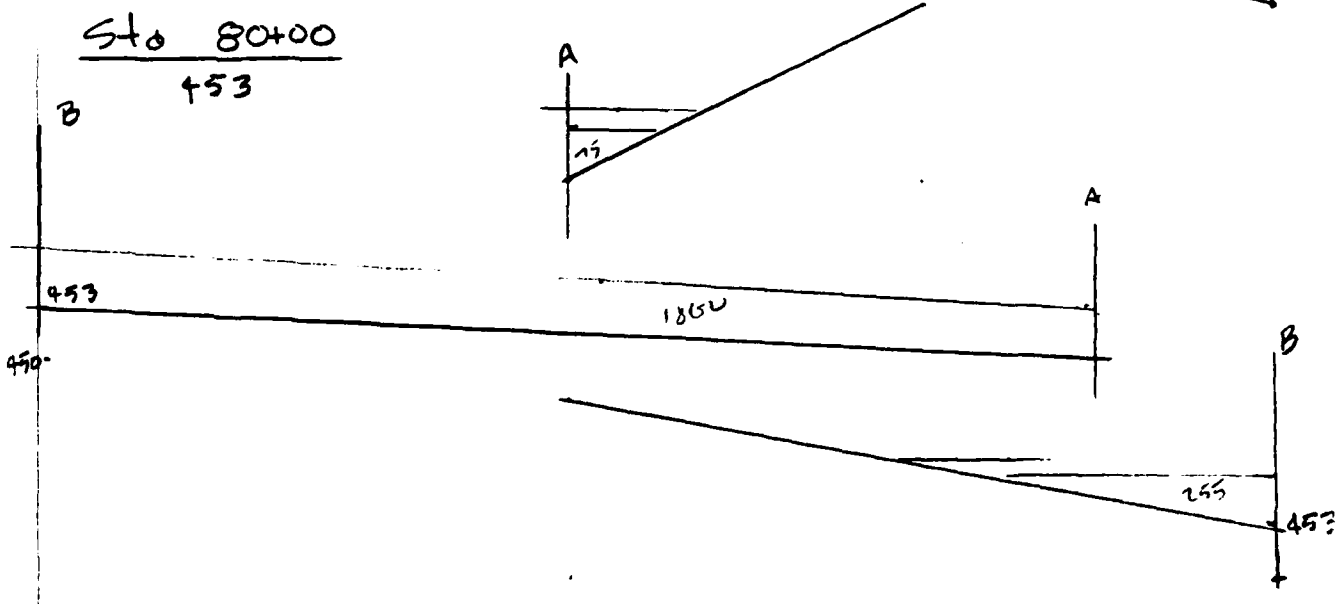
Sta 75+00

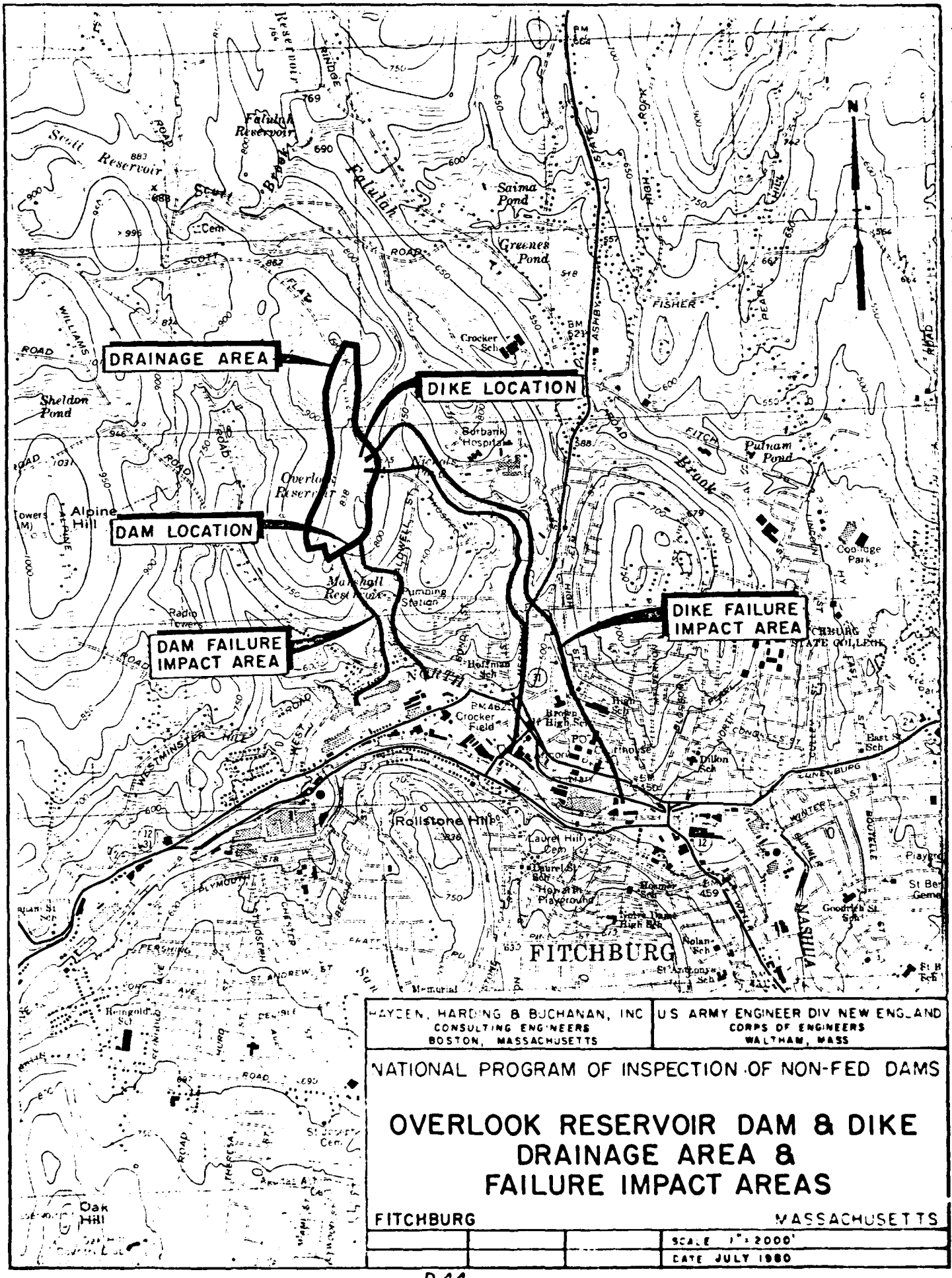
457



Sta 80+00

453





HAYDEN, HARDING & BUCHANAN, INC
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

OVERLOOK RESERVOIR DAM & DIKE
DRAINAGE AREA & FAILURE IMPACT AREAS

FITCHBURG MASSACHUSETTS

SCALE 1" = 2000'

DATE JULY 1980

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
MA	1535	NED	MA	027	04				OVERLOOK RESERVOIR DIKE	4235.9	7149.0	15	AUG	80

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	OVERLOOK RESERVOIR

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	09	TR NORTH NASHUA RIVER	FITCHBURG	0	38976

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) NORMAL (ACRE–FT.)
HEPG	1872	S	25	25	250	187

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	15AUG80

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) TYPE	(32) WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	900	U	10	1447												

(38) OWNER	(39) ENGINEERING BY	(40) CONSTRUCTION BY
CITY OF FITCHBURG	UNKNOWN	UNKNOWN

(41) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(42) INSPECTION BY	(43) INSPECTION DATE DAY	MO	YR	(44) AUTHORITY FOR INSPECTION
HAYDEN HARDING & BUCHANAN INC	17	JUN	80	PL 92-367

(45) REMARKS
50 EXCLUDING 370 FT MAIN DAM

END

FILMED

7-85

DTIC